STUDY OF ENVIROMENTAL POLLUTION

BY

PETROL ENGINES

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DECLARATION

A report submitted to the Department of Mechanical and Chemical Engineering for the partial Fulfillment of the requirement for Higher Diploma in Mechanical Engineering.

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As authors we bear the responsibility for all interpretations, opinions and errors in this work.

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1.1 INTERNAL COMUSTION ENGINES.

The purpose of internal combustion engines is the production of mecahnical power from chemical energy contained in the fuel.In internal combustion engines,this energy is released by burning or oxidizing the fuel inside the engines.The fuel -air mixture before combustion and the burned productsafter combustion are the actual working fluids.The works transfer which provides the desired power output occur directly between these working fluids and the mechanical componenets of the engines.Internal combustion engines are ignitions engines (sometimes called Otto engines,or gasoline or petrol engines.Because of thier simplicity,ruggedness and hihg power\weight ratio,these two types of engines have found wide application in transportation(land,sea,and air)and power generation.It is the fact that combustion takes place in inside the work production part of these engines taht makes thier design and opretaing characteristics fundamentally diffrent from those of other of engines.

1.2 HISTORICAL BACKGROUND.

An atmospheric engine introduced in 1867 by nicolaus A.otto (1832-1891)and Eugen langen (1833-1895)-used the pressure rise resulting from combustion of the fuel -air charge really in the outer stroke to accelerate a free piston and rack assembly so its momentum would generate a vacuum in the cylinder. Atmospheric pressure then pushed the piston inward, with rack engaged through a roller clutch to the output shaft. Production engines, of which about 5000 web built, obtained thermal efficienciesof up to 11 percents.A slide valve controlled intake, ignition by a gas flame, and exhaust.

To overcome this engine's shortcomings of low thermal efficiencies and excessive weight, Otto proposed an engine cycle with four piston strokes: an intake stroke, then a compression stroke before ignition, an expansion or power stroke where work was delivered by crankshaft, and finally an exhaust stroked. He also proposed incorporating a stratified-charged induction system, though this was not achieved in practiced. His prototype four-stroke engine first ran 1876. A comparison between the Otto engine and its atmospheric-type processor indicates the reason for its success the enormous reduction in engine weight and volume this was the break through that effectively founded the internal combustion engine industry. By 1890, almost 50,000 of these engines had been sold in Europe and United States.

Further development followed fast once the full impact of what Otto had achieved became apparent.by the 1880 several engineers (e.g dugald clerk, 1854-1913, and James robson, 1833-1913, in England and Kael benz, 1844-1929, in Germany0had successfully developed two-stroke internal combustion engines where the exhaust and intake processor occur during the ends of power stroked and the beginning of the compression stroke.

1.3 CLASSIFICATION OF I.C ENGINES.

The internal combustion engines may be classified in many ways, but the following are important from the subject point of view:

1. According to the type of fuel used

(a)petrol engines,(b)diesel engine or oil engines and(c) gas engnes.

2.According to the method of igniting the fuel

(a)spark ignition engines (briefly written as S.I engines),

(b)Compression ignition engines (briefly written as C.I engines),and (c) hot Spot ignition engines.

3. According to the number of stroke per cycle

(a) four stroke cycle engines, and (b) two stroke cycle engines.

1. Based on the fuel used

Diesel Engine, Petrol Engine (or Gasoline Engine)

2. Based on ignition cycle

Otto Cycle Engine, Diesel Cycle Engine, Dual Cycle Engine

3. Based on the number of strokes per cycle

Two-stroke engine, Four-stroke Engine

4. Based on the number of cylinders

Single Cylinder Engine, Multi cylinder Engine, Twin Cylinder Engine, Three Cylinder Engine, Four Cylinder Engine, Six Cylinder Engine, Eight Cylinder Engine, Twelve Cylinder Engine, Sixteen Cylinder Engine

5. Based on the type of ignition

Spark Ignition Engine (S.I. Engine), Compression Ignition Engine (C.I. Engine)

6. Based on the lubrication system used

Dry sump lubricated engine, Wet sump lubricated Engine

7. Based on the cooling system used

Air-cooled Engine, Water-cooled Engine

8. Based on the arrangement of valves

L-head Engine,I-head Engine,T-head Engine,F-head Engine

9.Based on the position of cylinders

Horizontal engine,Vertical Engine,Radial Engine,Opposed Piston Engine,Opposed Cylinder Engine,V Engine,W Engine,Inline

Engine

10.Based on the pressure boost given to the inlet air or air-fuel mixture

Naturally aspired Engine,Supercharged Engine,Turbocharged Engine,Crankcase compressed Engine

11.Based on application

Automobile Engine,Aircraft Engine,Locomotive Engine,Marine Engine,Stationary Engine

FUNDAMENTALS OF PETROL ENGINE:

A petrol engine (known as a gasoline engine in American English) is an internal combustion engine with spark-ignition, designed to run on petrol (gasoline) and similar volatile fuels. The first practical petrol engine was built in 1876 in Germany by Nikolaou's August Otto, although there had been earlier attempts by Étienne Lenoir, Siegfried Marcus, Julius Hock and George Bryton. The first petrol combustion engine (one cylinder, 121.6 cm3 displacement) was prototyped in 1882 in Italy by Enrico Bernardi. In most petrol engines, the fuel and air are usually pre-mixed before compression (although some modern petrol engines now use cylinder-direct petrol injection). The pre-mixing was formerly done in a carburetor, but now it is done by electronically controlled fuel injection, except in small engines where the cost/complication of electronics does not justify the added engine efficiency. The process differs from a diesel engine in the method of mixing the fuel and air, and in using spark plugs to initiate the combustion process. In a diesel engine, only air is compressed (and therefore heated), and the fuel is injected into very hot air at the end of the compression stroke, and self-ignites

1.5 4-S and 2-S CYCLE OF PETROL ENGINE:

A four-stroke engine (also known as four cycle) is an internal combustion (IC) engine in which the piston completes four separate strokes while turning a crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

1) Intake: This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion.

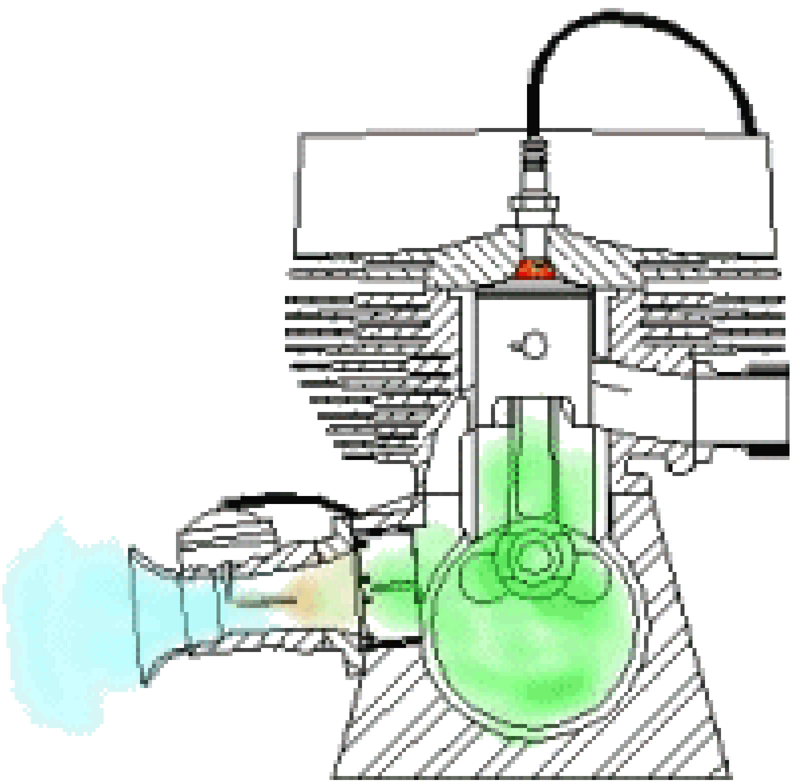
2) Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the

piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

3) Combustion: This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

4) Exhaust: During the exhaust stroke, the piston once again returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve

A two-stroke, or two-cycle, engine is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution. This is in contrast to a "four-stroke engine", which requires four strokes of the piston to complete a power cycle. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust (or scavenging) functions occurring at the same time.



1.6 USES OF PETROL ENGINES

Spart ignition engines are used in many application: in the home as lawn mowers, chain saws etc, in portable power generation, as outboard motorboat engines, and in motorcycles.also in cars, autoricksshaws and light weight vehicles. Sometimes used in airplanes as well.

1.7 PROBLEMS ASSOCIATED WITH PETROL ENGINES

Running cost of petrol engine is high because of higher petrol cost.

Thermal efficiency is around 26%,which is quite low.

Overheating trouble is more due to low thermal efficiency.

CH.2.0 OPERATION OF PETROL ENGINES:

2.1 Operating cycle

2.2 Friction between moving components

2.3 Lubrication system

2.4 Fuel supply system

2.5 Combustion process

2.6 Exhaust emissions

2.7 Rates of exhaust emission

2.8 Emission from other sources

2.1 OPERATING CYCLE:

When an engine continuously working, we may consider a cycle starting from any stroke. When the engine returns back to the stroke where it started we say that one cycle has been completed. Different sequence of operations in 4-stroke and 2-stroke cycle petrol engine which is widely used are described as below:

(a) 4-stroke cycle petrol engine:

It is also known as the Otto cycle. The technically correct term is actually four stroke cycle? The four stroke engine is probably the most common engine type nowadays. It powers almost all cars and trucks. The four stroke of a petrol engine sucking fuel-air mixture (petrol mixed with proportionate quantity of air in the carburetor known as charge)are described below:

1. Suction or charging stroke: The stroke of an engine or pump during which a charge is being drawn in: in an internal-combustion engine, the stroke during which the

combustible charge is drawn in preparatory to being compressed before it is exploded.

2. Compression stroke:

The compression stroke is the second of four stages in an Otto cycle or diesel cycle internal combustion engine.

In this stage, the mixture (in the case of an Otto engine) or air (in the case of a Diesel engine) is compressed to the top of the cylinder by the piston until it is either ignited by a spark plug in an Otto engine or, in the case of a Diesel engine, reaches the point at which the injected fuel spontaneously combusts, forcing the piston back down. In a Diesel engine, the injection of fuel usually leads top dead center by about 4 mechanical degrees, this "lead" being intended to allow complete fuel ignition to occur slightly after top dead center.

Compression serves to increase the proportion of energy which can be extracted from the hot gas and should be optimized for a given application. Too high a compression can cause detonation, which is undesirable compared with a smooth, controlled burn. Too low a compression may result in the fuel/air mixture still burning when the piston reaches the bottom of the stroke and the exhaust valve opens.

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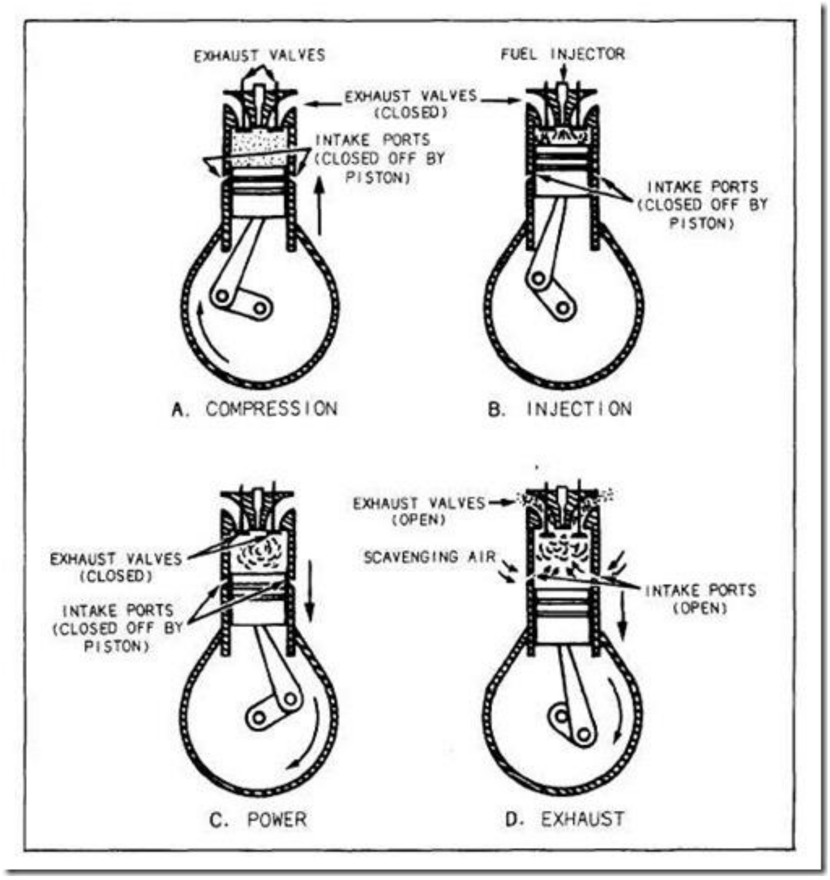


Fig-The four stroke petrol engine.

3.Expansion or Working stroke:

A power stroke is, in general, the stroke or movement of a cyclic motor while generating force and thus power. It is used in describing mechanical engines. This force is the result of the spark plug igniting the compressed fuel-air mixture (in Petrol Engines).

4.Exhaust stroke:

The exhaust stroke is the fourth of four stages in a |four stroke internal combustion engine cycle. In this stage gases remaining in the cylinder from the fuel ignited during the compression step are removed from the cylinder through an exhaust valve at the top of the cylinder. The gases are forced up to the top of the cylinder as the piston rises and are pushed through the opening, which then closes to allow a fresh air/fuel mixture into the cylinder so the process can repeat itself.

(b) Two stroke cycle petrol engine:

The first commercial two-stroke engine involving in-cylinder compression is attributed to Scottish engineer Dugald Clerk, who patented his design in 1881. However, unlike most later two-stroke engines, his had a separate charging cylinder.a two stroke engine has a ports instead of valves.All the four stages of two -stroke petrol engines are described below:

1. Suction or Intake:

The fuel/air mixture is first drawn into the crankcase by the vacuum that is created during the upward stroke of the piston. The illustrated engine features a poppet intake valve; however, many engines use a rotary value incorporated into the crankshaft.

2. Compression stage:

During the downward stroke, the poppet valve is forced closed by the increased crankcase pressure. The fuel mixture is then compressed in the crankcase during the remainder of the stroke.

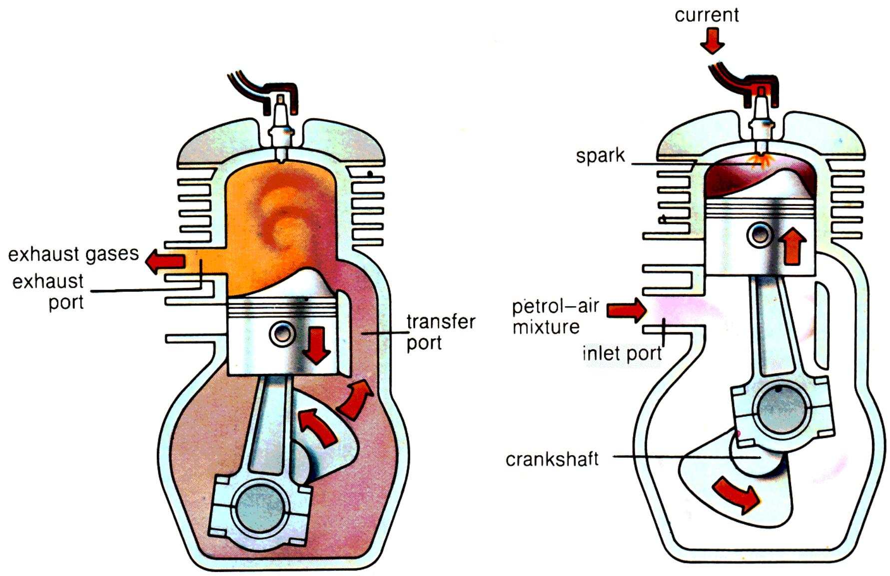


Fig The two stroke petrol engine cycle.

3. Expansion stage:

The high pressure gas exiting the cylinder initially flows in the form of a "wave front" as all disturbances in fluids do. The exhaust gas pushes its way into the pipe which is already occupied by gas from previous cycles, pushing that gas ahead and causing a wave front. Once the gas flow stops, the wave continues, passing the energy to the next gas downstream and so on to the end of the pipe. If this wave encounters any change in cross section or temperature it will reflect a portion of its strength in the opposite direction to its travel.

4. Exhaust:

Toward the end of the stroke, the piston exposes the intake port, allowing the compressed fuel/air mixture in the crankcase to escape around the piston into the main cylinder. This expels the exhaust gasses out the exhaust port, usually located on the opposite side of the cylinder. Unfortunately, some of the fresh fuel mixture is usually expelled as well.

2.2 FRICTION BETWEEN TWO COMPONENTS:

The piston and crank assembly contributes the largest friction components.

1. PISTON ASSEMBLY FRICTION:

Piston rings have been an area of considerable focus and development for internal combustion engines. The needs of diesel engines and small piston-ported two-stroke engines have been particularly difficult. Piston rings may account for a considerable proportion of the total friction in the engine, as much as 24%. This high friction is a result of the design compromises needed to achieve good sealing and long lifetime. Sealing is achieved by multiple rings, each with their own function, using a metal-on-metal sliding contact. A piston is a cylindrical engine component that slides back and forth in the cylinder bore by forces produced during the combustion process. The piston acts as a movable end of the combustion chamber. The stationary end of the combustion chamber is the cylinder head. Pistons are commonly made of a cast aluminum alloy for excellent and lightweight thermal conductivity. Thermal conductivity is the ability of a material to conduct and transfer heat. Aluminum expands when heated, and proper clearance must be provided to maintain free piston movement in the cylinder bore. Insufficient clearance can cause the piston to seize in the cylinder. Excessive clearance can cause a loss of compression and an increase in piston noise.Automobles engines normally use three rings, though two designs exist.

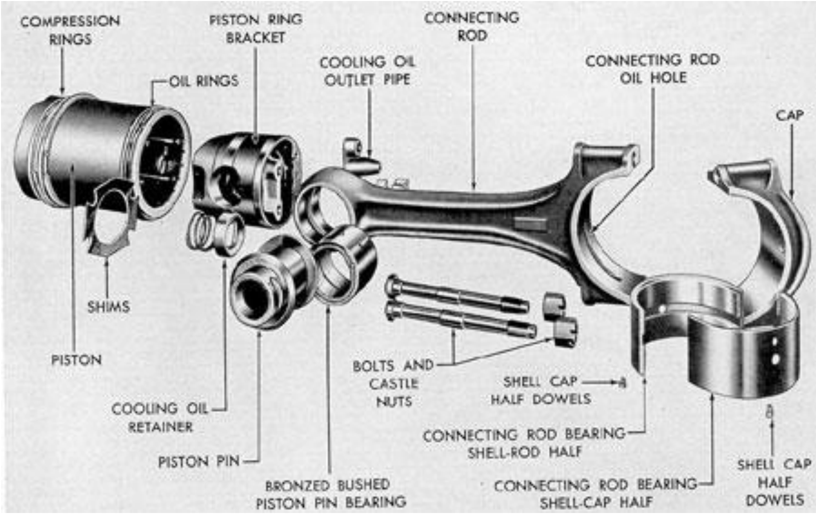


FIG.Construction and nomenclature of typical piston and ring assembly.

2.CRANKSHAFT BEARING FRICTION:

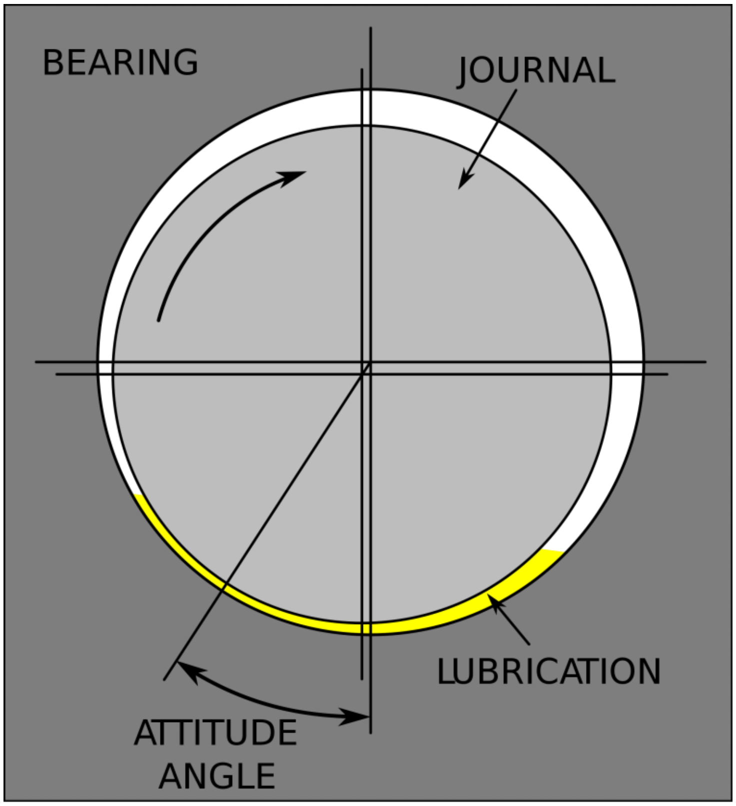


Fig.Schematic of hydrodynamically Lubricated journal bearing.

Crankshaft friction contribution comes from journal bearings (connecting rod, main and accessory or balance shaft bearings) and their associated seals. A schematic of a journal bearing operating under hydrodynamic lubrication is shown in Fig.

2.3 LUBRICATION SYSTEM:

1. Four stroke lubrication:

A 'Splash' type of lubrication system, this was employed in the earliest days of engine development. The system comprised a sump or crankcase with a set amount of oil enclosed within it. As the rotating crankshaft and connecting rod dipped into the oil at the bottom of the stroke it picked up and lubricated all of the lower parts of the engine. This type of lubrication underwent small design modifications. These included a rod which extended down vertically from the big end bearings, dipping into the oil in the sump and therefore picking up a little more oil. There were several designs of these. There are also accounts of con-rod and flywheel modifications. These were done for the sole purpose of getting the oil higher up the crankcase. The inherent side effect of this system of lubrication is that the crankshaft was subjected to oil drag as it splashed through the oil in the bottom of the engine.

These early engines employed mainly white metal and plain bronze bearings with crude seals. They were slow revving, being low in performance as well as in crankshaft and gearbox speed. As engines developed, the customer and therefore the manufacturer required more speed and with this came higher revs. The stroke of the latter day engines had to be shortened to attain these revs. With the increase in revolutions came increased performance and higher piston speeds. Basically all the internal workings of the engine were subjected to higher rotating and reciprocating speeds.

Oil development and improvement had crept a long with improved engine designs. The ball type bearing had replaced many of the plain bearings and seals were becoming more effective. A more modern lubrication system was required the keep up with the performance changes.

2. Two stroke Lubrication:

Two-cycle engines can be found nearly everywhere these days. They are used in dozens of applications and in a wide variety of designs for everything from work and recreation to power generation. Two-cycle engines have design differences and operate under conditions that require different oil chemistries than their four-cycle counterparts. In order to recommend a lubricant for a two-cycle engine, one needs to know how this engine operates, why it is used in place of a four-cycle engine and where and in what type of applications it is used.

Two-cycle motors are considered total-loss type lubricating systems. Because the crankcase is part of the intake process, it cannot act as an oil sump as is found on four-cycle engines. Lubricating traditional two-cycle engines is done by mixing the oil with the fuel. The oil is burned upon combustion of the air/fuel mixture. Direct Injection engines are different because the fuel is directly injected into the combustion chamber while the oil is injected directly into the crankcase. This process is efficient because the fuel is injected after the exhaust port closes, and therefore more complete combustion of fuel occurs and more power is developed. Direct injection engines have a higher power density than traditional two-cycle engines. Because the oil is directly injected into the crankcase, less oil is necessary and lower oil consumption results (80:1 range). Direct Injection motors have higher combustion temperatures, often up to 120F. They also require more lubricity than traditional two-cycle motors.

2.4 FUEL SUPPLY SYSTEM:

In petrol engine the petrol is mixed with air in the carburetor and then supplies it to engine cylinder.

Types of fuel supply system:-

1) Gravity feed system.

2) Pressure feed system.

Gravity feed system:-

In this system the petrol is supply to the engine by gravitational force.

In this system the level of fuel is high than engine, due to the level tank the petrol will automatically supply by gravitational force this system is having fuel tank, cock, filter, and carburetor.

The cock is very important in this system because there is a possibility of leakage the cock is having three position that is on, of and reserve.

This system used in two wheeler and three whites.

Pressure feed system:-

In this system the petrol is supplied with pressure by fuel pump.

In this system the fuel tanks is fitted at lover level of engine so that petrol cannot flow automatically hence fuel pump is used.

The fuel pumps suck the fuel from tank and give the pressure to petrol and supply it engine.

It this system the parts use are :- (1) fuel tank (2) fuel pump (3) filter (4) car by ratter (5) pipe line. In this system sedan four wheeler.

Component of fuel supply System:-

Comment [A1]:

Fuel Tank.

Filter.

Fuel pump.

Carburetor.

Fuel tank:-

Fuel tank is made up from thin metal sheet of different size and shape. This tank is having antirust citing in side.

It stores the fuel and supplies it to engine.

It is having filter mole it is. Also having advent plug.

It is also having a drain plug to drain the fuel at the time of cleaning.

Fuel filter:-

It is used to clean the petrol generally petrol fuel is made up from porcelain material.

The mole in side it and forcing partial stopped there and clear petrol supplied to engine.

Fuel pump: -

Fuel Pumps are divided into two categories Mechanical fuel pump and Electrical fuel pump.

Mechanical fuel pump:-

Mechanical fuel pump it is operated by mechanically that means by eccentric of cam shaft.

The parts of Mechanical Fuel Pumps are:-

1] Upper body

2] Lover body.

3] Valve plate.

4] Diaphragm.

5] Return spring.

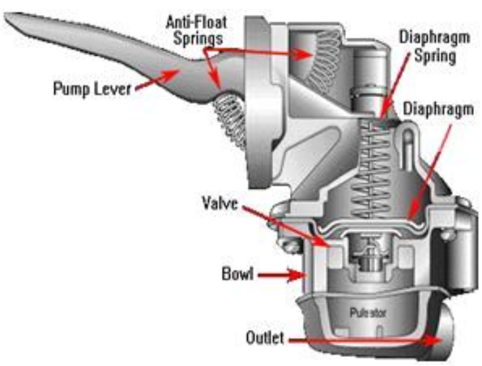
6] Push rod.

7] Rocker arm.

Construction of Mechanical Fuel Pump: -

Mechanical fuel pump shown in figure.

Mechanical fuel pump



Mechanical fuel pump

The diaphragm is hold in between upper body and lower body, above the diathermy valve plate is provides.

The push rod of diaphragm is connected to rocker arm.

Working of Mechanical Fuel Pump: -

When engine rotates, the cam rotates with crank shaft.

When the eccentric pushed the rocker arm up.

The push rod pulls down so that diaphragm will be in cup shape, this creates vacuum and suck the petrol in pump.

When eccentric goes down diaphragm up this will compressed the petrol and supply it to carburetor.

Electric fuel pump:-

It is operated on electric current so that known as electric fuel pump.

The parts used in Electric Fuel Pumps are:-

1] Diaphragm.

2] Pushrod.

3] C.B. point

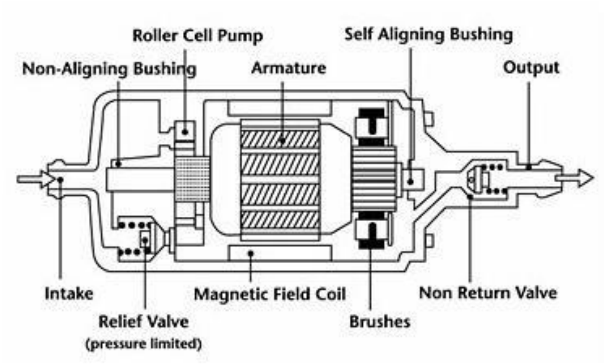
4] Valve plate.

5] Coil.

Working of Electric Fuel Pump:-

Electric fuel pump shown in figure.

Electric fuel pump



Electric fuel pump

When drier gives ignition switch the electric current flows to the coil, the magnet is produced which pulls the push rod up so that due to the vacuum below the diaphragm petrol is sucks in pump simultaneously C.B point will get open so that no electric supply will flow to coil which will collapse magnetism fields so that the spring pushed the diaphragm to warts down which compresses petrol and supply it to carburetor.

When diaphragm pushes down simultaneously C.B point will make contact and the process repeat number of time. (Continuously).

2.4(a) ELECTRONIC FUEL INJECTION SYSTEM:

Fuel injection is a system for admitting fuel into an internal combustion engine. It has become the primary fuel delivery system used in automotive engines, having replaced carburetors during the 1980s and 1990s. A variety of injection systems have existed since the earliest usage of the internal combustion engine.

Supplying the fuel to the engine

Fuel is transported from the fuel tank (via fuel lines) and pressurized using fuel pump(s). Maintaining the correct fuel pressure is done by a fuel pressure regulator. Often a fuel rail is used to divide the fuel supply into the required number of cylinders. The fuel injector injects liquid fuel into the intake air (the location of the fuel injector varies between systems).

Unlike carburetor-based systems, where the float chamber provides a reservoir, fuel injected systems depend on an uninterrupted flow of fuel. To avoid fuel starvation when subject to lateral G-forces, vehicles are often provided by an anti-surge vessel, usually integrated in the fuel tank, but sometimes as a separate, small anti-surge tank.

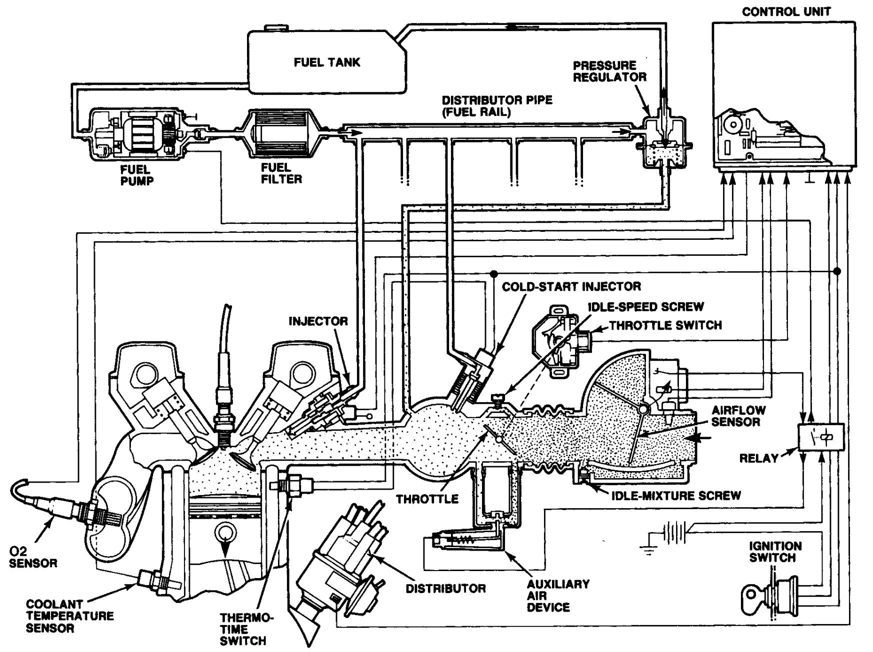


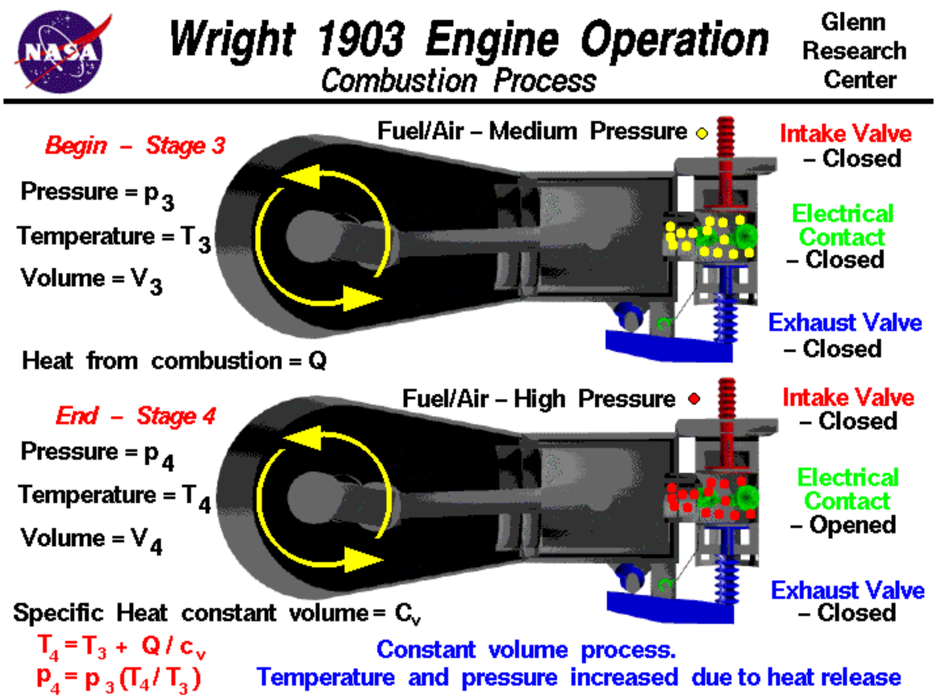
Figure 17-14. The Bosch L-Jetronic system has been used on various Japanese, European, and domestic vehicles. (Bosch)

2.5 COMBUSTION PROCESS:

Most vehicle fuels (gasoline, diesel, natural gas, ethanol, etc.) are mixtures of hydrocarbons, compounds that contain hydrogen and carbon atoms. In a “perfect” engine, oxygen in the air would convert all of the hydrogen in fuel to water and all of the carbon in the fuel to carbon dioxide (carbon mixed with oxygen). Nitrogen in the air would remain unaffected. In reality, the combustion process is not “perfect,” and automotive engines emit several types of pollutant.

For the forty years following the first flight of the Wright brothers, airplanes used internal combustion engines to turn propellers to generate thrust. Today, most general aviation or private airplanes are still powered by propellers and internal combustion engines, much like your automobile engine. On this page we will discuss the fundamentals of the internal combustion engine using the Wright brothers' 1903 engine, shown in the figure, as an example.

The brothers' design is very simple by today's standards, so it is a good engine for students to study to learn the fundamentals of engine operation. This type of internal combustion engine is called a four-stroke engine because there are four movements (strokes) of the piston before the entire engine firing sequence is repeated. In the figure, we have colored the fuel/air intake system red, the electrical system green, and the exhaust system blue. We also represent the fuel/air mixture and the exhaust gases by small colored balls to show how these gases move through the engine. Since we will be referring to the movement of various engine parts, here is a figure showing the names of the parts.



2.6 EXHAUST EMISSIONS:

Exhaust gas or flue gas is emitted as a result of the combustion of fuels such as natural gas, gasoline, petrol, biodiesel blends, diesel fuel, fuel oil, or coal. According to the type of engine, it is discharged into the atmosphere through an exhaust pipe, flue gas stack, or propelling nozzle.

It is a major component of motor vehicle emissions (and from stationary internal combustion engines), which can also include:

Crankcase blow-by Evaporation of unused gasoline

Motor vehicle emissions contribute to air pollution and are a major ingredient in the creation of smog in some large cities.

(a)What's in the exhaust?

The main exhaust products and their effects on the environment and our health.

Nitrogen (N_2) - no adverse effects

Oxygen (O_2) - no adverse effects

Water (H_2O) - no adverse effects

Carbon Dioxide (CO_2) - non-toxic gas but contributes towards acidification of oceans and one of the most important greenhouse gases. Governments around the world are pursuing policies to reduce CO_2 emissions to combat global warming.

Carbon Monoxide (CO) - results from incomplete combustion of fuel. CO reduces the ability of blood to carry oxygen and can cause headaches, respiratory problems and, at high concentrations, even death.

Oxides of Nitrogen (NO_x) - produced in any combustion process, NO_x emissions are oxidized in the atmosphere and contribute to acid rain. They react with hydrocarbons to produce low level ozone which can cause inflammation of the airways, reduced lung function and trigger asthma, and also contribute to the formation of particulate matter.

Sulphur Dioxide (SO_2) - sulphur occurs naturally in the crude oil from which petrol and diesel are refined. It forms acids on combustion leading to acid rain and engine corrosion. It also contributes to the formation of ozone and of particulate matter. Sulphur can also adversely affect the performance of catalytic converters and is now removed from both petrol and diesel during the refining process.

Hydrocarbons (HC) - HCs are emitted from vehicle exhausts as unburnt fuel and also through evaporation from the fuel tank, from the nozzle when you fill up and also at stages through the fuel supply chain. They react with NOx in sunlight to produce photochemical oxidants (including ozone), which cause breathing problems and increased symptoms in those with asthma.

Benzene (C_6H_6) - naturally occurring in small quantities (less than 2%) in petrol and diesel, Benzene is emitted from vehicle exhausts as unburnt fuel and also through evaporation from the fuel system although modern fuel systems are sealed and have carbon canisters to hold the vapor's. Benzene is toxic and carcinogenic. Long-term exposure has been linked with leukemia.

Lead (Pb) - lead accumulates in body systems and is known to interfere with the normal production of red blood cells. Following the introduction of unleaded petrol and withdrawal of leaded petrol lead is essentially eliminated as an exhaust product.

Particulates (PM) - particulate matter is partly burned fuel associated mainly with diesel engines and is also formed by the reaction between other pollutants. PM10s and the smaller PM2.5s are particles that can pass deep into the lungs causing respiratory complaints and contributing to the risk of developing cardiovascular diseases. Modern diesel cars are fitted with Diesel Particulate Filters (DPF) to stop these particles passing into the atmosphere.

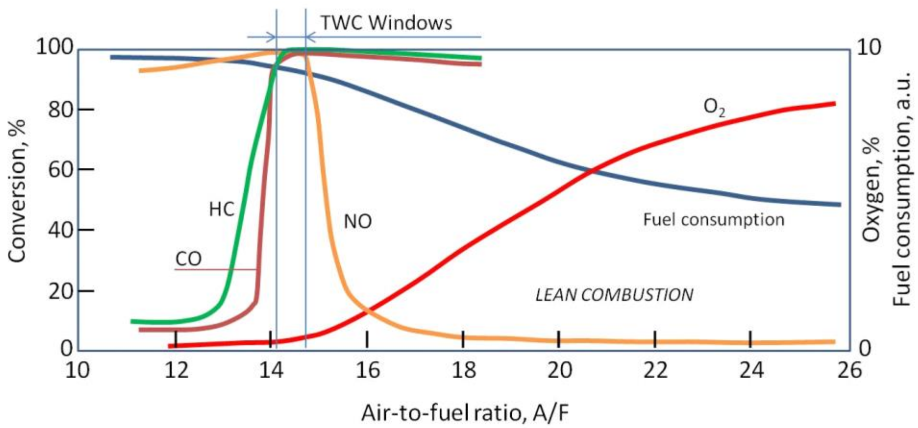


Fig Exhaust vs air-fuel ration for petrol engines.

Ch.3.0 Pollutants from petrol engines

3.1 Fuels for the SI engine

3.2 Important qualities of SI engine Fuels

3.3 Sources and classification of pollutants from petrol engine

3.4 Method of detection & measurement of pollutant.

3.1

1. • Natural gas is a mixture of hydrocarbons, mainly methane, and is produced either from gas wells or in conjunction with crude oil production. • Natural gas is consumed in the residential, commercial, industrial, and utility markets. • Natural gas can either be stored onboard a vehicle as compressed natural gas (CNG) or as liquefied natural gas (LNG). Natural gas can also be blended with hydrogen Natural Gas.

2. CNG costs are at Rds. 40/kg much cheaper than petrol at Rds. 70/liter. The cost saving is immense along with reduced emissions and environment friendly. The use of CNG is mandatory for public transport in New Delhi as well as for Ahmedabad. The Delhi Transport Corporation operates the world's largest fleet of CNG buses.

3. Natural Gas Pros • Lower emissions • Lower smog producing gases (60-90% Light-Duty use, 90% in Mid to Heavy-duty use) • Can be used to make hydrogen to power the future fuel cell technology Future of natural gas • Natural gas is now being installed in 1 out of 5 transit buses today • Fueling systems are being installed in home or public facilities • Gradually the automobiles shift to natural gas fuel.

4. Propane • Propane is a liquefied gas made up of propylene, butane, and butylene from petro chemicals. • By-product of

natural gas processing and crude oil refining. What are the benefits? • A 98% reduction in toxic emissions in light-duty bi-fuel vehicles • in the quantities needed it costs less than gasoline • Very accessible compared to other alternative fuels.

5. Propane Properties • HD5, the automotive propane standard, a mixture of 90% propane and other hydrocarbons (propylene). • Contains 33% - 41% less energy content per gallon than gasoline. • Vehicles can demonstrate a 60% reduction in ozone-forming emissions compared to gasoline. • High octane properties (104) allow vehicles to operate with higher compression ratios; leads to higher efficiency/fuel economy

6. • Used in light- and medium-duty vehicles, heavy-duty trucks and buses. • Many propane vehicles are converted gasoline vehicles. (Conversion kits include regulator/vaporizer, air/fuel mixer, oxygen-monitoring closed-loop feedback system, and special fuel tank.) Propane

7. Propane Future • Currently 200,000 vehicles in the US use propane (mostly fleet vehicles like taxis and police cars) • Since the current infrastructure can easily be converted to dispense propane it makes for a cost effective solution to gasoline by using the current fuel dispensing system

8. • Methanol is wood alcohol, which can be made from natural gas, coal, or wood. • Methanol is produced from natural gas in production plants with 60% total energy efficiency. • Methanol can be made with any renewable resource containing carbon

such as seaweed, waste wood and garbage. • Methanol fuel cells will greatly reduce carbon dioxide emissions for vehicles and virtually eliminate smog and particulate pollution. Methanol

9. Methanol Pros • Lower emissions • Higher performance • Lower risk of flammability • Methanol can be used to easily make hydrogen Cons • The biggest is the lack of vehicles to use it, manufactures have stopped making vehicles to run on Methanol

10. Conclusion Alternative fuels generally lower emissions making them appealing for environmental concerns. Many of these fuels are renewable and would lessen the need for petroleum products. A lot of these fuels are going to be used with the developing fuel cell technology.

3.2

The fuel must have certain physical, chemical and combustion properties in general which are enumerated below:-

High energy density.

Good combustion qualities.

High thermal stability.

Low deposit forming tendencies.

Compatibility with the engine hardware.

Good fire safety.

Low toxicity.

Low pollution.

Easy transferability and onboard vehicle storage.

These properties are elaborated by dividing the fuels for SI and CI engines. Fuels used in ic engines should possess certain basic qualities which are important for smooth running of engines. In this section the important qualities of fuels for both SI and CI engines are shown.

Gasoline which is mostly used in the present day SI engines is usually a blend of several low boiling paraffin's, naphthalene's and aromatics in varying proportions. Some of the important qualities of gasoline are discussed below.

Volatility:- Volatility is one of the main characteristic properties of gasoline which determines its suitability for use in an SI engine. Since gasoline is a mixture of different hydrocarbons, volatility depends on the fractional composition of the fuel. The usual property of measuring the fuel volatility is the distillation of the fuel in special device at atmospheric pr. And the presence of its own vapour. The fraction that boils off at a definite temp is measured. The characteristic pontes are the temperature at which 10, 40, 50 and 90% of the volume evaporates as well as temperature at which boiling of the fuel terminates. The method of measuring volatility is standardized by American Society of Testing Materials (ASTM) and the graphical representation of the tests is generally termed as the ASTM distillation curve. The more important aspects of volatility related to engine fuels are discussed in the following bits.

Starting and warming up :- A certain part of gasoline should vaporize at room temperature for easy starting of the engine. Hence the portion of the distillation curve between 0 and 10% boiled off have relatively low boiling temperatures. As the engine warms up, the temperature will gradually increase to the operating temperature. Low distillation temperatures are desirable throughout the range of the distillation curve for best warm-up.

Operating range performance :- In order to obtain good vaporization of the gasoline, low distillation temperatures are preferable in the engine operating range. Better vaporization tends to produce both more uniform distribution of fuel to the cylinders as well as better acceleration characteristics by reducing the quantity of liquid droplets in the intake manifold.

Crankcase dilution :- Liquid fuel in the cylinder causes loss of lubricating oil(by washing away oil from the cylinder walls) which deteriorates the quality of lubrication and tends to cause damage to the engine through increased friction. The liquid gasoline may also dilute the lubricating oil and weaken the oil film between rubbing surfaces. To prevent this situation, the upper portion of the distillation curve should exhibit sufficiently low distillation temperatures to ensure that all gasoline in the cylinder is vaporized by the time the combustion starts.

Vapour lock characteristics: - High rate of vaporization of fuel can upset the carburetor metering or even stop the fuel flow to the engine by setting up a vapour lock in the fuel passages. This characteristic demands the presence of relatively high boiling temperature throughout the distillation range.

Antiknock quality: - Abnormal burning or detonation in an SI engine combustion chamber causes a very high rate of energy release, excessive temperature and pressure inside the cylinder adversely effects its thermal efficiency. Therefore, the characteristic of fuel should be such that it reduces the tendency to detonation and this property is called its antiknock property. The antiknock property of a fuel depends on the self-ignition characteristics of its mixture and vary largely with the chemical composition and molecular structure of fuel. In general, the best SI engine fuel will be that having the highest antiknock property, since this permits the use of higher compression ratios and thus the engine thermal efficiency and the power output can be greatly increased.

Gum deposits: - Reactive hydrocarbons and the impurities in the fuel have a tendency to oxidize and form liquid and solid gummy substances. Unsaturated hydrocarbons are more prone to form gum deposits. Gum deposits may lead to clogging of carburetor jets and enlarging of the valve stems, cylinders and pistons.

Sulphur content: - Hydrocarbon fuels may contain free sulphur, hydrogen sulphide and other sulphur compounds which are objectionable for several reasons. The sulphur is the corrosive element of the fuel that can corrode fuel lines, carburetors and injection pumps and it will unite with oxygen to form sulphur dioxide that, in presence of water at low temperatures, may form sulphurous acid. Since sulphur has a low ignition temperature, the presence of sulphur can reduce the self-ignition temperature, then promoting knock in the SI engine.

3.3

The earth's atmosphere contains various gases, water vapor and suspended particles. The dry air of the atmosphere is composed of four major gases nitrogen, oxygen, argon and carbon dioxide that account for more than 99.5% (Table).

The other gases found in traces in the air include helium, methane, krypton, hydrogen, carbon monoxide, nitrous oxide (N2O), nitrogen dioxide (NO2), ammonia, ozone, sulfur dioxide and hydrogen sulfide.

The lower part of the atmosphere (up to about 12 km) also contains water vapor at a concentration, ranging from 0.01 to 5.0%. This water is mostly contributed by evaporation from the hydrosphere.

TABLE 55.1 Composition of the dry air in the lower atmosphere

Gas	*Composition (% by volume)*
Nitrogen	78.08
Oxygen	20.95
Argon	0.93
Carbon dioxide	0.03
Trace gases (He, CH_4, Kr, H_2, CO, N_2O, NO_2, NH_3, O_3, SO_2, H_2S)	> 0.02

The air is getting contaminated by pollution due the natural and unnatural activities of man. Air pollution is basically the presence of foreign substances in the air at a concentration that will adversely affect the health and property of the individual.

As per the World Health Organization (WHO) criteria, air pollution refers to 'the substances put into the air by the activity of mankind into concentration sufficient to cause harmful effects to his health, vegetables, property or to interfere with the enjoyment of his property.'

According to Indian Standards Institution 'air pollution is the presence in ambient atmosphere of substances generally resulting from the activity of man, in sufficient concentration, present for sufficient time and under circumstances which interfere significantly with the comfort, health or welfare of a person or with the full use or enjoyment of his property.'

3.4

There are many ways to measure air pollution, with both simple chemical and physical methods and with more sophisticated electronic techniques. There are four main methods of measuring air pollution.

Passive sampling methods provide reliable, cost-effective air quality analysis, which gives a good indication of average pollution concentrations over a period of weeks or months. Passive samplers are so-called because the device does not involve any pumping. Instead the flow of air is controlled by a physical process, such as diffusion. Diffusion tubes are simple passive samplers, which provide very useful information regarding ambient air quality. They are available for a number of pollutants, but are most commonly and reliably used for nitrogen dioxide and benzene. The tubes, which are 71mm long with an internal diameter of 11mm, contain two stainless steel gauzes placed at one end of a short cylinder. The steel gauzes contain a coating of triethanolamine, which converts the nitrogen dioxide to nitrite. The accumulating nitrates are trapped within the steel gauze, ready for laboratory analysis. The tube is open to the atmosphere at the other end, which is exposed downwards to prevent rain or dust from entering the tube. To ensure that all the nitrogen dioxide originates from the test site, the tubes are sealed before and after exposure. The tubes are manually distributed and collected, and are analysed in a laboratory.

Active sampling methods use physical or chemical methods to collect polluted air, and analysis is carried out later in the laboratory. Typically, a known volume of air is pumped through a collector (such as a filter, or a chemical solution) for a known period of time. The collector is later removed for analysis. Samples can be collected daily, providing measurements for short time periods, but at a lower cost than automatic monitoring methods.

Automatic methods produce high-resolution measurements of hourly pollutant concentrations or better, at a single point. Pollutants analyzed include ozone, nitrogen oxides, sulphur dioxide, carbon monoxide and particulates. The samples are analyzed using a variety of methods including spectroscopy and gas. The sample, once analyzed is downloaded in real-time, providing very accurate information.

Remote optical / long path-analyzers use spectroscopic techniques, make real-time measurements of the concentrations of a range of pollutants including nitrogen dioxide and sulphur dioxide.

The amount of pollution in the air, however sampled, is usually measured by its concentration in air. The concentration of a pollutant in air may be defined in terms of the proportion of the total volume that it accounts for. Concentrations of pollutant gases in the atmosphere are usually measured in parts per million by volume (ppmv), parts per billion by volume (ppbv) or parts per trillion (million million) by volume (pptv).

Pollutant concentrations are also measured by the weight of pollutant within a standard volume of air, for example microgrammes per cubic metre (µgm-3) or milligrammes per cubic metre (mgm-3).

CH.5.0 Effects of Pollutants

5.1 Introduction

5.2 Effects on Human Health

5.3 Effects on Enviroment

5.4 Economic Effects of air pollution

4.0

Introduction:

Many emissions standards focus on regulating pollutants released by automobiles (motor cars) and other powered vehicles. Others regulate emissions from industry, power plants, small equipment such as lawn mowers and diesel generators, and other sources of air pollution.

An emission performance standard is a limit that sets thresholds above which a different type of emission control technology might be needed. While emission performance standards have been used to dictate limits for conventional pollutants such as oxides of nitrogen and oxides of sulfur (NOx and SOx), [1] this regulatory technique may be used to regulate greenhouse gasses, particularly carbon dioxide (CO2). In the US, this is given in pounds of carbon dioxide per megawatt-hour (lbs. CO2/MWhr), and kilograms CO2/MWhr elsewhere.

4.1

United States of America:

Main article: United States emission standards

In the United States, emissions standards are managed by the Environmental Protection Agency (EPA). Under federal law, the state of California is allowed to promulgate more stringent vehicle emissions standards (subject to EPA approval), and other states may choose to follow either the national or California standards. California had produced air quality standards prior to EPA, with severe air quality problems in the Los Angeles metropolitan area. LA is the country's second-largest city, and relies much more heavily on automobiles and has less favorable meteorological conditions than the largest and third-largest cities (New York and Chicago).

California's emissions standards are set by the California Air Resources Board, known locally by its acronym "CARB". By mid-2009, 16 other states had adopted CARB rules; [3] given the size of the California market plus these other states, many manufacturers choose to build to the CARB standard when selling in all 50 states. CARB's policies have also influenced EU emissions standards. [citation needed]

California is attempting to regulate greenhouse gas emissions from automobiles, but faces a court challenge from the federal government. The states are also attempting to compel the federal EPA to regulate greenhouse gas emissions, which as of 2007 it has declined to do. On May 19, 2009 news reports indicate that the Federal EPA will largely adopt California's standards on greenhouse gas emissions.

California and several other western states have passed bills requiring performance-based regulation of greenhouse gases from electricity generation.

In an effort to decrease emissions from heavy-duty diesel engines faster, the California Air Resources Board's Carl Moyer Program funds upgrades that are in advance of regulations.

The California ARB standard for light vehicle emissions is a regulation of equipment first, with verification of emissions second. The property owner of the vehicle is not permitted to modify, improve, or innovate solutions in order to pass a true emissions only standard set for their vehicle. Therefore, California's attempt at regulation of emissions is a regulation of equipment not of air quality. This form of regulation prevents most grassroots type creative individuals from participating in the math science and engineering that could lead to breakthroughs in this area of research. They are wholly excluded from modifying their property in any way that has not been extensively researched and approved by CARB. This could be entirely prevented by regulating and testing emissions only.

The EPA has separate regulations for small engines, such as grounds keeping equipment. The states must also promulgate miscellaneous emissions regulations in order to comply with the National Ambient Air Quality Standards.

4.3

European Union:

Main article: European emission standards

The European Union has its own set of emissions standards that all new vehicles must meet. Currently, standards are set for all road vehicles, trains, barges and 'nonroad mobile machinery' (such as tractors). No standards apply to seagoing ships or airplanes.

EU Regulation No 443/2009 sets an average CO_2 emissions target for new passenger cars of 130 grams per kilometre. The target is gradually being phased in between 2012 and 2015. A target of 95 grams per kilometre will apply from 2021.

For light commercial vehicle, an emissions target of 175 g/km applies from 2017, and 147 g/km from 2020,[4] a reduction of 16%.

The EU introduced Euro 4 effective January 1, 2008, Euro 5 effective January 1, 2010 and Euro 6 effective January 1, 2014. These dates had been postponed for two years to give oil refineries the opportunity to modernize their plants.

4.4

In Canada, the Canadian Environmental Protection Act, 1999 (CEPA 1999) transfers the legislative authority for regulating emissions from on-road vehicles and engines to

Environment Canada from Transport Canada's Motor Vehicle Safety Act. The Regulations align emission standards with the U.S. federal standards and apply to light-duty vehicles (e.g., passenger cars), light-duty trucks (e.g., vans, pickup trucks, and sport utility vehicles), heavy-duty vehicles (e.g., trucks and buses), heavy-duty engines and motorcycles.

5.0

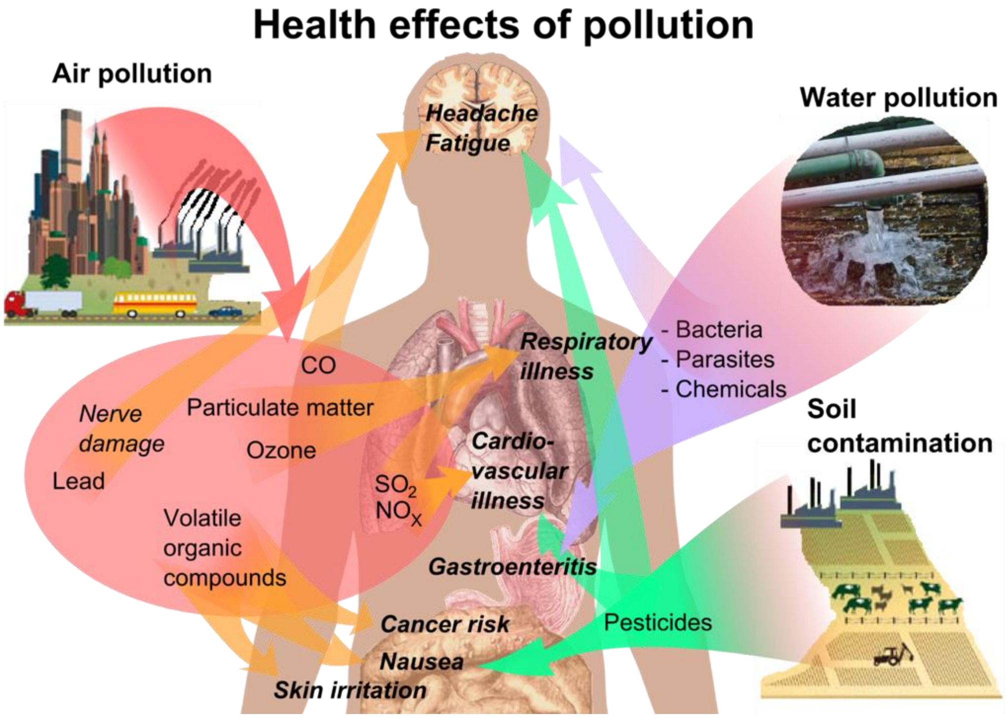
Introduction:

One of the greatest problems that the world is facing today is that of environmental pollution, increasing with every passing year and causing grave and irreparable damage to the earth. Environmental pollution consists of five basic types of pollution, namely, air, water, soil, noise and light. A pollutant is a waste material that pollutes air, water or soil. Three factors determine the severity of a pollutant: its chemical nature, the concentration and the persistence.

5.2

Adverse air quality can kill many organisms including humans. Ozone pollution can cause respiratory disease, cardiovascular disease, throat inflammation, chest pain, and congestion. Water pollution causes approximately 14,000 deaths per day, mostly due to contamination of drinking water by untreated sewage in developing countries. An estimated 500 million Indians have no access to a proper toilet, Over ten million people in India fell ill with waterborne illnesses in 2013, and 1,535 people died, most of them children. Nearly 500 million Chinese lack access to safe drinking water. A 2010 analysis estimated that 1.2 million people died prematurely each year in China because of air pollution. The WHO estimated in 2007 that air pollution causes half a million deaths per year in India.Studies have estimated that the number of people killed annually in the United States could be over 50,000.

Oil spills can cause skin irritations and rashes. Noise pollution induces hearing loss, high blood pressure, stress, and sleep disturbance. Mercury has been linked to developmental deficits in children and neurologic symptoms. Older people are majorly exposed to diseases induced by air pollution. Those with heart or lung disorders are at additional risk. Children and infants are also at serious risk. Lead and other heavy metals have been shown to cause neurological problems. Chemical and radioactive substances can cause cancer and as well as birth defects.



5.3

Pollution has been found to be present widely in the environment. There are a number of effects of this:

Biomagnification describes situations where toxins (such as heavy metals) may pass through trophic levels, becoming exponentially more concentrated in the process.

Carbon dioxide emissions cause ocean acidification, the ongoing decrease in the pH of the Earth's oceans as CO2 becomes dissolved.

The emission of greenhouse gases leads to global warming which affects ecosystems in many ways.

Invasive species can out compete native species and reduce biodiversity. Invasive plants can contribute debris and biomolecules (allelopathy) that can alter soil and chemical compositions of an environment, often reducing native species competitiveness.

Nitrogen oxides are removed from the air by rain and fertilise land which can change the species composition of ecosystems.

Smog and haze can reduce the amount of sunlight received by plants to carry out photosynthesis and leads to the production of tropospheric ozone which damages plants.

Soil can become infertile and unsuitable for plants. This will affect other organisms in the food web.

Sulfur dioxide and nitrogen oxides can cause acid rain which lowers the pH value of soil.

5.4

Contamination of coastal areas with high amenity value is a common feature of many oil spills. In addition to costs incurred by clean-up activities, serious economic losses can be experienced by industries and individuals dependent on coastal resources. Usually, the tourism and fisheries sectors are where the greatest impacts are felt. However, there are also many other business activities and sectors that can potentially suffer disruptions and loss of earnings.

Poor air quality affects Canadians in a variety of far-reaching ways, from our physical health, to our environment, to our economy.

The impacts of air pollution on the economy include direct economic impacts as well as indirect economic impacts stemming from the human health and environmental effects of air pollution.

Reducing air pollution would lead to significant benefits to the socio-economic well-being of Canadians. Reductions in illness and mortality have direct social benefits and also improve the productivity of Canadian industry and decrease health care costs. Air pollution reductions have the potential to directly increase the productivity of the forestry, agriculture, fishing, and tourism industries by decreasing environmental damages suffered by these industries. Being among the world leaders in reducing air pollution may also lead to innovative new industries and economic spin-offs related to green technology in Canada.

There are also costs to reducing air pollution though. Reducing emissions by cutting production, switching fuels or installing scrubbers can cost producers money. Developing and enforcing instruments such as regulation also costs governments money. To a varying degree, costs to producers and governments are ultimately paid for by Canadians through higher taxes and prices.

Although the costs of reducing air pollution can be high at times, most recent cost-benefit studies such as Cost-Benefit

Analysis: Replacing Ontario's Coal-Fired Electricity Generation (2005) demonstrate that at current pollution levels, the potential benefits to Canadians of air pollution reductions are much greater than the costs of those reductions.

Internationally, evidence suggests that high levels of environmental stewardship and strict regulation don't necessarily compromise a country's economic competitiveness or standard of living. Many U.S. states and nations of the world with stringent environmental regulations show excellent economic performance.

Canadians pay for poor air quality

As with other forms of pollution, the full social costs of air pollution in Canada continue to be borne by the public through damage to the environment and public health. For example, the Ontario Medical Association has estimated that air pollution costs more than $1 billion a year in hospital admissions, emergency room visits, and absenteeism.

Clean air and the sustainable economy

Clean air is essential for the long term health of Canadians and the Canadian environment. Clean air will also contribute substantially to the long term competitiveness of the Canadian economy, by improving worker productivity, and increasing the productive capacity of several key Canadian industries.

A number of tools are being used, including regulations and partnerships, to encourage activities that support both the environment and the economy. For instance, new technologies, cleaner fuels, science and research, electricity production and conservation, alternative transportation, and new forms of infrastructure can stimulate economic growth in a way that also helps the environment.

CH.6.0 Methods of Emission control

6.1 Introduction

6.2 Use of catalytic converters

6.3 Guardening Against evaporation emissions

6.4 Control of Lead Emissions.

6.0

Introduction:

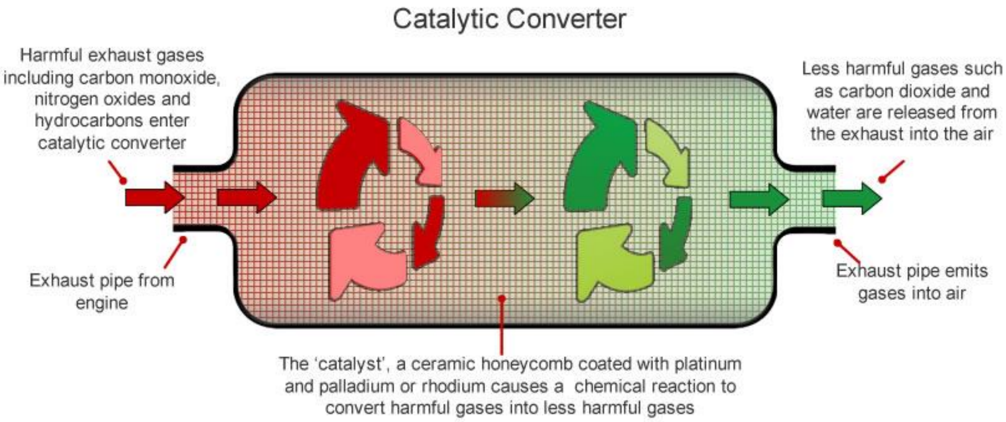
To control the pollution it is necessary to measure the emissions coming out from the engine. Emissions are of two types i.e. invisible & visible emissions. These emissions are very harmful to the environment & human beings, so it is necessary to control these emissions. The methods used to control the emissions are discussed here in this term paper. First method is thermal converter in this the temperature play the important role to control the emission. Catalytic converter is the method in which by using the catalyst we reduce the temperature requirement for the different reactions to occur efficiently it reduce the temperature required. In particulate traps method we use the trap system to control the amount of particulates released to the atmosphere. We also use chemicals to control the emission in this chemical react with the emission and reduce its harmful effect. Exhaust gas recirculation is also one of the methods to control the emission in this we recirculate the exhaust gas and reborn it. There're also many other methods used to control the emissions discussed in this term paper but the main methods are those discussed above. In other methods there is air injection method, ceramic engine coating, and evaporative emissions control method.

6.2

A catalytic converter is an emissions control device that converts toxic gases and pollutants in exhaust gas to less toxic pollutants by catalyzing a redox reaction (an oxidation and a reduction reaction). Catalytic converters are used with internal combustion engines fueled by either petrol (gasoline) or diesel—including lean-burn engines as well as kerosene heaters and stoves.

The first widespread introduction of catalytic converters was in the United States automobile market. To comply with the U.S. Environmental Protection Agency's stricter regulation of exhaust emissions, most gasoline-powered vehicles starting with the 1975 model year must be equipped with catalytic converters. These "two-way" converters combined oxygen with carbon monoxide (CO) and unburned hydrocarbons (HC) to produce carbon dioxide (CO_2) and water (H_2O). In 1981, two-way catalytic converters were rendered obsolete by "three-way" converters that also reduce oxides of nitrogen (NO_x);[1] however, two-way converters are still used for lean-burn engines. This is because three-way-converters require either rich or stoichiometric combustion to successfully reduce NO_x.

Although catalytic converters are most commonly applied to exhaust systems in automobiles, they are also used on electrical generators, forklifts, mining equipment, trucks, buses, locomotives and motorcycles. They are also used on some wood stoves to control emissions.This is usually in response to government regulation, either through direct environmental regulation or through health and safety regulations.

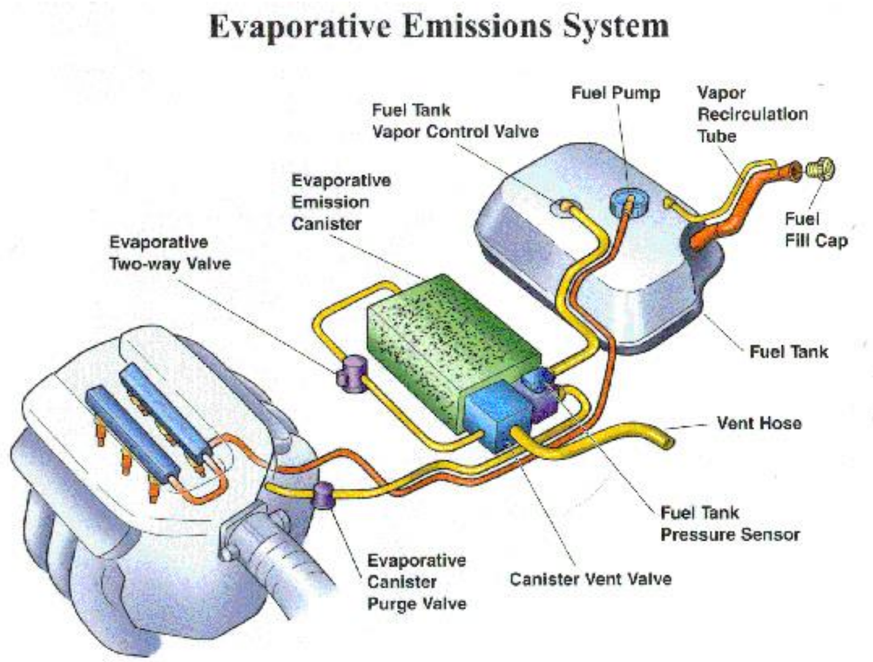


6.3

Approximately 20%of all hydrocarbon (HC) emissions from the automobile originate from evaporative sources. The Evaporative Emission Control (EVAP) System is designed to store and dispose of fuel vapors normally created in the fuel system; thereby, preventing its escape to the atmosphere. The EVAP system delivers these vapors to the intake manifold to be burned with the normal air/fuel mixture. This fuel charge is added during periods of closed loop operation when the additional enrichment can be managed by the closed loop fuel control system. Improper operation of the EVAP system may cause rich driveability problems, as well as failure of the Two Speed Idle test or Enhanced I/M evaporative pressure or purge test.

The EVAP system is a fully closed system designed to maintain stable fuel tank pressures without allowing fuel vapors to escape to the atmosphere. Fuel vapor is normally created in the fuel tank as a result of evaporation. It is then transferred to the EVAP system charcoal canister when tank vapor pressures become excessive. When operating conditions can tolerate additional enrichment, these stored fuel vapors are purged into the intake manifold and added to the incoming air/fuel mixture.

The old EVAP control system is a system which utilizes the intake manifold vacuum to draw the evaporative emissions into the intake manifold and mix then in with the intake air. The ECM controls a duty–cycle type VSV (vacuum switching valve) to purge the evaporative emissions from the charcoal canister.



6.4

Lead is the most recycled element among all of non-ferrous metals. More than 90% Lead worldwide is being recycled from Lead-Acid Battery Scrap which is tremendously increading day by day inaccord with advanced technology. Battery recycling industry is acknowledged worldwide as a model of product recycling. Eco-friendly battery recycling process prevents large nos. of Lead contents / dust & restore it for further process as well as this process saves energy and reduces environmental pollution as compared to primary production of Lead. It also facilitates recycling of other materials such as polypropylene battery casings etc.

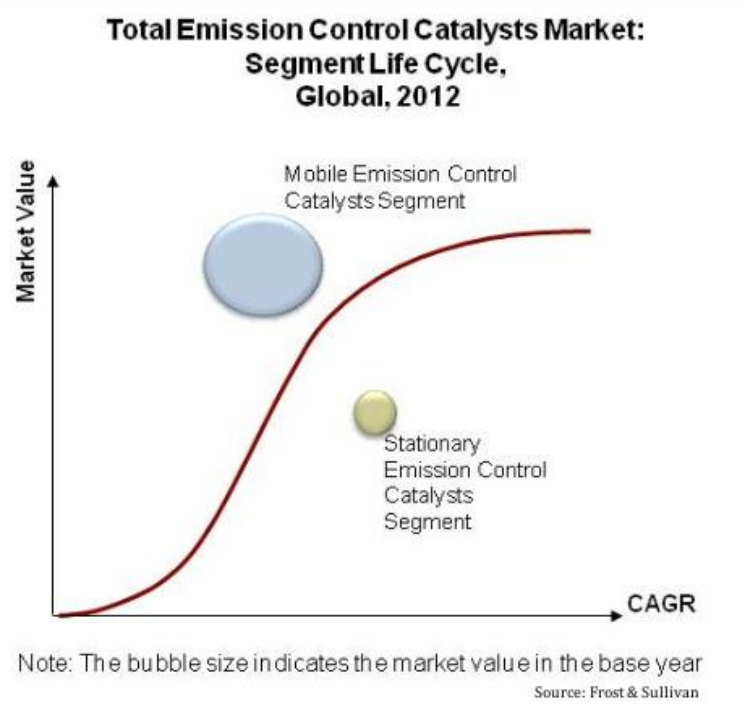
As Lead is a hazardous metal, following environmental guidelines and eco-friendly business practices is important in Battery Recycling. Gravitas has been fully committed to the environment and provides environment-friendly solutions since inception. All of Company's business processes and operations are aligned with environmental aims. Developing more effective pollution control solutions and promoting modern pollution control technologies is one of our thrust areas. We provide plants integrated with efficient pollution control modules, at competitive capital costs, with the objective of widespread adoption of modern, eco-friendly designs and technologies.

All processing industries generate waste. The quantities generated and their potential impacts depend on many factors, including the level of industrial development, the way in which wastes are managed, the existing state of the local environment and the capacity of the receiving media. The gases & fumes generated in the system are effectively controlled by the Pollution control Equipment. The amount of Lead content emitted with these gases is being collected at every stage of pollution control equipment's.

SOX – Sulphur content present in the gases are being treated with water

CO, Lead Dust, Lead Ash etc. – These are controlled by different sections of Pollution Control Equipment.

NOX – Not formed because of the lower level of temperatures of the furnace.



DISCUSSION

Evidence shows that a number of chemicals that may be released into the air or water can cause adverse health effects. The associated burden of disease can be substantial, and investment in research on health effects and interventions in specific populations and exposure situations is important for the development of control strategies. Pollution control is therefore an important component of disease control, and health professionals and authorities need to develop partnerships with other sectors to identify and implement priority interventions.

CONCLUSIONS.

Urban air pollution has long been a serious problem in the FSU, reflecting both the importance of highly polluting, resource-intensive industries for the national economy and political factors such as the low priority of environmental issues and lack of public participation. At the beginning of the transition from a centrally planned to a free market economy and a more open society, it was assumed that environmental performance in the FSU would improve. In particular, a shift away from heavy industries to less resource-intensive sectors and improvements in energy efficiency were expected to reduce air pollution levels. All countries of the FSU experienced a decline in industrial output following the change in economic regime and emissions of main pollutants have fallen as a result of a slump in production.

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