



# Diesel-Gasoline Exhaust Particles (DGEPs) and Its Impact on Human Health

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**Abstract:** For increasing of transport system and industrial system, the amount of Diesel-Gasoline Exhaust Particles (DGEPs) is also increasing day by day. DGEPs contains various gasses such as nitrogen oxide, Sulphur oxide, many carbon compounds like carbon monoxide, ammonia, cyanide, organic substance like benzene, toluene etc. Worldwide urbanization and industrialization are cause of horrible pollution. We can divide DGEPs into two parts like DEP (particles emitted from diesel combustion) and GEP (particles emitted from gasoline combustion). DGEPs show the harmful effects on human respiratory system, immune system, cardiovascular system, nervous system, endocrine system and reproductive system. We review ultimately the human exposures to DEPs and GEPs and summarized the investigation into association between DGEPs and effects on various human systems.

**Keywords:** DEPs, GEPs, Source, composition, Mode of Exposure, Health Effects, and control of DGEPs.

## I. INTRODUCTION

With the progression of time, science also developed, due to this development of science, civilization also moving on. Increasing of transport system and industrial system, the amount of Diesel-Gasoline Exhaust Particles (DGEPs) also increased day by day. We can divide DGEPs into two parts like DEP (particles emitted from diesel combustion) and GEP (particles emitted from gasoline combustion). Sometimes we can call them DGEPs together. DGEPs are produced primarily by the complete and incomplete combustion from industrial machinery and vehicles. DGEPs are submicron and ultrafine particles such as carbon monoxide, sulphur oxide and nitrogen oxide, organic aromatic molecules those can affect human health. These harmful gasses and particles can affect cardiovascular system, immune system, endocrine system and especially on respiratory system. Chronic emission of DGEPs effects on bronchoalveolar system and also cause for lungs cancer. Many epidemiological studies indicate the association of DEPs and other air pollutants with human morbidity and mortality, exacerbation asthma, ischemic heart disease, stroke. According to various studies, the diesel engine emits the same amount of pollutants as the gasoline engine. PAHs or (Polycyclic aromatic hydrocarbons) associated gasoline exhaust particles [GEPs] has mutagenic as well as carcinogenic action on human body. In recent US, Europe and Japan have extended their control of emission of DGEPs from all kind of vehicles such as firming vehicles and locomotives, marine vehicles and stationary generator applications.<sup>[1][2]</sup>

## II. RESEARCH METHODOLOGY

In this paper we endeavor to center related to DGEPs and its impacts on human health. In this work, crucial examination framework is utilized as assistant data sources of DGEPs are news, articles, environmental pollution books, webpages of source, composition, mechanism of exposure, human health impact and control.

### III. SOURCE AND COMPOSITION OF DGEPs

. The major sources of DGEPs are mainly transportation including on road trucks, busses and many motor vehicles. Diesel-Gasoline exhaust quantity depends on the engine technology, fuel quality and type of fuels, catalysis etc. The main and major components of DGEPs are carbon monoxide, sulphur oxides, nitrogen oxides (NO<sub>x</sub>) and organic compounds including aromatic and alkaline substances. Various major sources of DEPs and GEPs are given in table 1. With a comparison between diesel engine and gasoline engine; diesel engine emits higher concentration of nitrogen and sulphur dioxide and organic molecules. Recent technology of engines changes the exhaust characteristics. Newer technology engine reduced emission of CO, organic substance, nitrogen oxide etc. The harmfulness of these particles depends on exposure level, chemical complexity and duration of exposure. We have summarized the sources and composition of DGEPs in Table-1: [3] [4]

DEPs			GEPs		
SOURCE	COMPOSITION	REFERENCE	SOURCE	COMPOSITION	REFERENCE
Various vehicles (Motor vehicles, bus, truck, heavy truck etc.)	Carbon monoxide (CO), Oxides of nitrogen (NO <sub>x</sub> ), Sulphur dioxide (SO <sub>2</sub> ), Hydrocarbons, Formaldehyde, Transition metal Carbon-particles.	[5]	Vehicles, Construction. Farming Landscaping, Small aircraft Sport utility vehicles, Electricity generators for portable.	Particulate matter (PM), Methane (CH <sub>4</sub> ), Total hydrocarbons (THC), Oxides of nitrogen (NO <sub>x</sub> ), Carbon monoxide (CO)	[7]
Marine Vehicles, Cruise ship	Sulphate, Organic matter (OM) Elemental carbon (EC), Ash, Metals such as iron, chromium silica etc.	[6]	An exhaust pipe, flue gas stack, or propelling nozzle and motor vehicles	Nitrogen, Water vapour and Carbon monoxide (incomplete combustion), Hydrocarbons (C <sub>x</sub> H <sub>y</sub> ) Black particulate matter	[8]
Industrial area	Carbon di oxide (CO <sub>2</sub> ), Various particulate matter, carbon monoxide, Nitrogen-di-oxide (NO <sub>2</sub> )	[5][6]	Gasoline fuel engine, internal combustion (IC) engine with spark ignition	Sulphur dioxide, Isocyanic acid (HNCO), Polycyclic aromatic hydrocarbon (PAHs)	[9]

Table-1: Major sources of DEPs and GEPs

### IV. MODE OF DGEPs EXPOSSURE

Diesel-Gasoline exhaust particles remain suspended in the atmosphere, by inhalation these harmful particles enter into the lungs. However, people living and working in urban area, industrial area and heavy traffic area exposure to these pollutants in every time. Gasoline's exhaust particles remain in gaseous state. So, they easily mixed with air and make air heavier than the fresh air. Air contain hazardous particle of gasoline exhaust particle is more concentrated than the pure air. Only 0.025 ppm of gasoline exhaust particles can lift up the threshold potential of odor sensation of human olfactory bulb. As the gasoline exhaust vapors are more concentrated and heavier than the fresh air, so they remain near the lowest part of atmosphere. Closed atmosphere with a large amount of gasoline exhaust vapors can be the cause of suffocation for a person, who is not wearing any type of mask. More intake of gasoline exhaust vapors results more damage in human body. So, lung surface area is proportional to the amount of damage in the body by the gasoline exhaust vapors. As child has more active lung surface area than adult person, so diesel- gasoline exhaust vapors are more dangerous for the children.

## V. IMPACT OF DGEPs ON HUMAN HEALTH

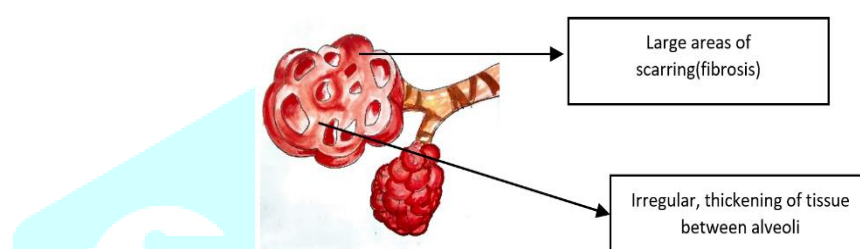
For better understanding we have discussed separately the impact of DGEPs on human health as system wise:

### ➤ Effects of DEPs on Human System: -

Huge exposure of DEPs (2.5µm PM) is associated with daily mortality. Day by day the increasing of DEPs affects mainly respiratory system, from respiratory system other body systems also be affected. These particles are microscopic and these DEPs are less than one fifth of the thickness of a single human hair and also enough for penetration into the deeper portion of lungs. From many controlled human exposure studies, we show the potentiality of DEPs on pulmonary and systemic inflammation. The effects of diesel exposures are surveyed in humans by based on question of symptoms which they faced, biopsy, bronchoscopy lungs function measurement.<sup>[10] [11]</sup>

Carbon monoxide is poisonous gas which is emitted as DEPs, once uptake, CO passes from our lungs into blood stream, where it gets attached with hemoglobin molecules to carry O<sub>2</sub>. O<sub>2</sub> is unable to bind hemoglobin that already saturated by CO. As a result, blood does not get enough O<sub>2</sub> from lungs. Due to this poor availability of O<sub>2</sub> whole body can force many troubles. Nitrogen oxide is also a harmful emission of DEPs. Elevated levels of nitrogen-di-oxide can cause of damage of respiratory tract and the severity of respiratory infections and asthma.<sup>[15]</sup>

DEPs are the cause of pulmonary fibrosis; lungs tissue became stiffer and thicker in this situation. A dry cough and shortness of breath is the common cause for pulmonary fibrosis, due to exhaustion of diesel particle (shown in Fig: 1):



**Fig: -1 Pulmonary Fibrosis**

High concentration of DEPs (300µg.m<sup>-3</sup>) causes an evaluation of cells and soluble component.<sup>[18]</sup>

According to a group of researchers, the inhalation of very fine particles of diesel exhaust conducts the inflammation of proximal airways and releases the mediators, those cause the blood coagulation. From another study, inhalation of DEP for long time and stored in lungs increase the inflammation and increase the level of plasma fibrinogen, which increase the risk for blood clotting and ischemic heart disease. DEPs also change the haemoglobin concentration, haematocrit and RBC count and also decrease the fibrinogen level and platelet number. Therefore, the blood coagulation will also hamper. From a survey of an acute DEP exposure area, the

BODY SYSTEM	EFFECTS	REFERENCES
Respiratory system	1) Lung injury through oxidative stress 2) Lung cancer 3) Pulmonary fibrosis 4) Chronic alveolitis 5) Inflammation of airway	[20], [21], [22]
Immune system	1) Allergic disorders like- asthma, stuffy nose, atopic child 2) Mast cell count shortening 3) Choking of body airways	[19], [27], [28], [30]
Cardiovascular system	1) BP alteration 2) Adverse heart rate 3) Thrombosis 4) Atherogenesis 5) High blood coagulation rate 6) Ischemic heart diseases 7) cardiac arrest	[32], [34], [35], [36]
Reproductive system	1) Less development of gonads due to less synthesis of Ad4Bp/SF-1 mRNA 2) Low testosterone synthesis	[44]

researchers measure the plasma albumin and they decided the result of increasing of peripheral sequestration of red blood cells is decreasing of haemoglobin rather that generalized haemodilution. Acute exposure of DEPs also affects the inflammatory substance of blood. We summarized all about effect of DEPs on human system, shown in the following Table 2:<sup>[18] [21] [24] [25] [26]</sup>

Table 2:- Effects of DEPs on Human system

➤ **Effects of GEPs On Human system:-**

In western countries, major passenger cars are driven by gasoline fuels. Though, diesel engine is more potent than gasoline engine, gasoline also emits various type of poisonous gas and particles, such as particulate matter (PM), total hydrocarbons (THC), oxides of nitrogen, isocyanic acid etc. Gasoline exhaust (GE) contains some carcinogenic component like benzene, polycyclic aromatic hydrocarbons (PAHs), which are called as GEPs (Gasoline exhaust particles). When these particles emit in environment it gives many human health body impact directly or indirectly. It effects on various system like respiratory system, cardiovascular system, developmental and neurological system of body. We summarized all about effect of GEPs on human health system shown in the following Table 3:

BODY SYSTEM	EFFECT	REFERENCE
Central nervous system (CNS)	1) Dizziness 2) Confusion 3) Nausea 4) Headache 5) Loss of consciousness 6) Coma	[28] [29]
Respiratory system	1) Pulmonary congestion 2) Intra pulmonary haemorrhage 3) Permanent lungs damage 4) Pneumonia	[31] [29]
Cardiovascular system	1) Heart pumping capacity decrease 2) Severe ventricular fibrillation.	[30] [29]
Renal	1) Fatty degeneration of the proximal convoluted tubules 2) Tubular necrosis 3) Haematuria	[29]
Dermal system	1) Rashes 2) Skin irritation 3) Redness	[28]

Table 3: -Effects of GEPs on Human System

## VI. CONTROL OF DGEPs

Diesel and gasoline are necessary for our lifework but the diesel and gasoline exhaust particles are more harmful for us. So, we should use it with some precautions. In recent US, Europe and Japan have extended their control of emission of DGEPs from all kind of vehicles such as firming vehicles and locomotives, marine vehicles and stationary generator applications.

We can use the substitute of diesel-gasoline fuel like dimethyl ether, diethyl ether. That is very effective to reduce the exposure of pollutant mainly NO<sub>x</sub> and CO.

### Commercial control: -

- 1) Many studies have shown that dimethyl ether can be made from waste of animals, food and agriculture. So, it can ever be carbon neutral. But in the DEPs and GEPs there are so many carbon compounds, so overall as much as possible we have to avoid the diesel and gasoline fuel as much as possible, rather than we can use the some substitute or alternatives of gasoline and diesel in table 4. We can use B5 (5% biodiesel +95% diesel) as an alternative of diesel. Next, we can use E85(85%ethanol+15%gasoline) as a substitute of gasoline, shown in Table-4:
  - We can use gas-electric hybrids, plug-in hybrids, electric car fuel cells, liquefaction and natural gas compresses and also use propane as fuel.
  - We have to stop using the older than 15 years engine of our car, otherwise we can use the diesel particulate filter with the diesel engine.
  - Reduce nitrogen oxide control in three steps: These are (a) Exhaust gas regeneration (EGR) (b) Catalyst (c) Water injection.

Gasoline	2.29
E10 (substitute of gasoline) (10% ethanol+90% gasoline)	2.21
E85(substitute of gasoline) (85% ethanol+15% gasoline)	1.61
Diesel	2.66
B5(substitute of diesel (5% biodiesel+95% diesel)	2.65
B20 (20% biodiesel+80% diesel)	2.62

Table 4: -Different types of substitute diesel and gasoline

Fuel Type CO<sub>2</sub> Emission (kg/L)

- We need to follow some ways to reduce fuel consumption such as-
  - a. Drive only when needed
  - b. Use different petrol filters
  - c. Make the car more airy
- 2) Moreover, changes in engine design can reduce emissions of DGPs. Engine and vehicle smoke tests should be checked regularly.

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