

**VEHICULAR EMISSION, ENVIRONMENTAL
AND HEALTH IMPLICATIONS**

A PAPER PRESENTED

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VEHICULAR EMISSION, THE ENVIRONMENTAL AND HEALTH IMPLICATION

Introduction

Vehicles and power plants derive their energies from the combustion of fossil fuel in their internal combustion chambers. If it was possible to achieve complete combustion, the fuel applied will be completely converted to energy to create the desired motion in case of automobile and to convert it to other forms of energy for various purposes like providing light etc. In the process of combustion, a number of changes occur. Some of the fuel is passed out unburned; partly burnt fuel changes form into a number of gases, impurities combine in the process principally with air to form other compounds e.g. oxides of sulphur, nitrogen from the air participate in the combustion process to form oxides of nitrogen NO, NO₂ depending on the prevailing conditions in the combustion chamber. The products of combustion mainly gases/particulate are then emitted into the environment as exhaust gases.

Vehicular emission is of concern particularly in urban environment that has low assimilative capacity. The emissions react forming various species in various meteorological conditions interfering with man's activities. To counter some of these effects like fog and breathing excessive amounts of these gases, researchers are trying to discover new sources of energy and power. There are now vehicles run entirely on natural gas as opposed to petrol.

Vehicular emission in typical urban centre constitute over 60% of total pollutant emission compared to industry, power plants, space heating, refuse disposal etc. See table 1 and 2. Hydrocarbons and nitrogen dioxide emitted principally from automobiles are the major ingredients of photochemical smog. This is evidence by the prevalence of smog problems in most down town areas of developed countries. Sizeable quantities of poisons such as aldehyde, lead, etc are also emitted by automobiles. From the two tables below, the significant contribution to emission from vehicles and in comparison with other sources is worrisome.

Table 1 Major sources of Emission in USA 1965 (million tons/year)

	Carbon Monoxide	Sulphur Oxide	Hydro Carbon	Nitrogen Oxide	Particulate Matter	Total	%
Motor Vehicle	66	12	6	1	1	86	60
Industry	2	9	4	2	6	23	17
Power Plants	1	12	1	3	3	20	14
Space Heating	2	3	1	1	1	8	6
Refuse Disposal	1	1	1	1	1	5	3
Total	72	26	19	13	12	142	100

Source: Atmospheric Pollution by W.Bach

Table 2 Comparison of average daily emission/tons day Los Angeles 1969

	Motor Vehicle	Power Plant	Jet Aircraft
Particulate	43	1	11
Carbon Monoxide	9.282	-ve	24
Nitrogen Oxide	624	135	7
Hydrocarbon	1,677	4	61
Sulphur dioxide	31	30	3

Source: Atmospheric Pollution by W. Bach.

Transportation

Mode of transportation in Nigeria is largely by road and air with little water transport in the coastal areas. The fleet of road vehicles has steadily increased from the 1950 to date. A study by Obio and Adegbulugbe in 1997 indicate that from 1950 to 1992, cars increased from 12,544 to 623,113, trucks 444 to 54,587, motorcycles 4,387 to 675,637 and that a total of 38451 vehicles in 1950 rose to 1,666,731 in 1992. This increase in 40 years has accounted for the rise in petrol consumption from 560,000 m³ in 1970 to 6,000,000 m³ in 1996. Consumption is projected to reach 10 million m³ in 2010 based on growth rate of 3% observed between 1985 – 1996.

Table 3 Road Vehicle Fleet (All Types)

Year	Total
1950	38451
1955	62009
1960	152296
1965	284203
1970	410078
1975	1,035,966
1980	2,045,997
1985	2,758,953
1990	2,004,118
1992	1,666,731

Source: Obio & Adegbulugbe.

The effect of all these is increased emission particularly with the prevalence of second-hand vehicles as old as 20 years being imported to this country. With the pegging of the age of second-hand vehicle to 5 years as allowable age to this country, we could have a sizeable reduction of emission.

O & M and Emission

Maintenance is key to efficient vehicle performance. A well-tuned vehicle is fuel-efficient and generates minimal emission. Unfortunately the mechanics we have are better described as destroyers. You need to visit one of them twice and the third time if you do not change, you must be fairly ignorant of what needs to be done. The result is that most of our vehicles are performing below standard, consuming excessive fuel and emitting excessive gaseous/particulates matter. The remedy lies in establishing credible maintenance workshops to service the fleet of vehicles in this country. Vehicle vendors should be compelled to establish workshops, as a follow-up action to sales of vehicles to customers and maintenance workshops should be licensed and vehicles now maintained by ill-equipped, ill-trained persons be stopped. This reasonable cost to discourage roadside ill-equipped patronage.

Habit of Vehicle Operatives

Personal driving habits as well as operating conditions can have marked effect on fuel economy and exhaust gas generation. The followings have influence on fuel economy and rate of generation of exhaust gases.

- ❖ Load – The vehicle tare weight from manufacture has the minimum fuel consumption. As load is increased, the engine has to do more work to pull the weight along. The energy to do this comes from burning more fuel, which is accompanied by emission. Depending on the fuel used, leaded and unleaded fuel, various gases/particulate like sulphur oxides, oxides of nitrogen (NOx) lead particulate are given off.
- ❖ Cold and hot starting – Cold starting of an engine has high fuel consumption. We should avoid rapid acceleration and sudden starts as these will result in high fuel consumption. Once the engine has been started, commence driving rather than accelerate rapidly standing which some people refer to as warming the engine. Apart from excessive cylinder wear, high fuel consumption result accompanied by emissions.
- ❖ Idling, city traffic shifting – All these are accompanied by high fuel consumption resulting in generation of exhaust gas and environmental pollution.
- ❖ Speed – Driving at high speeds for extended period apart from wearing the engine burns more fuel and therefore vent high volumes of gaseous/particulate matters with attendant environmental pollution. Slight release of the accelerating pedal on long distance travel saves significant amount of fuel. Tyres that are not properly gauged increases the inertia which has high energy demand and therefore high emission. More fuel is therefore expended in moving vehicles with lower than recommended tyres pressure apart from the effects on tyre wear and stability on the road.

Lead In Petrol

Petrol as derived from the earth's crust may contain lead depending on the constituent of the formation. This is usually small and in most cases insignificant. The petrol used in the internal combustion engines has to conform to certain specification to generate power. In processing the crude, some fractions of low molecular weight easily come out but with low rating referred to as the octane number. For this fraction to be useful for powering automobiles, the octane number has to be raised. To do this a compound of lead called Tetraethyl lead (Tel) is used. This introduces lead into the petrol raising the octane number and functions as lubricant for valve seats. With these two beneficial qualities, we should have no problem in promoting leaded petrol.

The combustion of petrol is inefficient in most cases and gases and particulates are emitted as exhaust gas/particulate. One of the perturbing ones is lead particulate, which has detrimental physiological affects. Ingestion of lead has been link to several physiological disorders in man such as interference with IQ of children of school age, gastrointestinal disorder, nausea, circulatory collapse, fatigue, blindness, CNS disorder, anaemia etc.

The use of leaded petrol therefore needs to be review in this country like in other countries of the world to reduce the health effects. It is possible to produce petrol of high and desirable octane number without the use of lead tetraethyl using appropriate technology e.g. cracking of higher molecular crude, use of methyl tetra-butyl ether (MBTE), Fluid Catalytic Cracker (F.C.C.) etc.

In Nigeria, except the Warri and old Port Harcourt refineries, the new Port Harcourt and Kaduna refineries are designed to produce unleaded petrol if the FCC are functioning properly although meeting demand may constrain the use of easier process.

Removing lead does not remove vehicular emission as hydrocarbon; oxide of sulphur and nitrogen will still be emitted. There will be need to do something about these too since they also present environmental problems aiding photochemical reaction mentioned earlier.

The defunct Federal Environmental Protection Agency undertook a study of levels of lead in six towns of Lagos, Aba, Abuja, Ibadan, Kaduna and Port Harcourt. The soil samples were taken from roadside, motor parks, markets, etc. The lead content were staggering as well as frightening as tabulated below

City	Range
Lagos	24.98-121.61 mg/kg
Ibadan	22.41-164.85 “
Kaduna	14.40-126.81 “
Abuja	5.24- 89.92 “
Port Harcourt	28.38- 67.78 “
Aba	2.34- 55.01 “

Suggestions/Recommendation

- While writing this paper, I was overwhelmed by the graduation ceremony I watched on television of graduates from Peugeot Automobile Nigeria (PAN) Technical School Kaduna of automobile technicians. This ties up with the call in this paper for proper servicing of vehicles for optimum performance and should be encouraged.
- The refineries in this country should be fully evaluated with the aim of redesigning them to produce entirely unleaded petrol in the very near future. The phase out should be gradual, over at least five (5) years to take care of those vehicles presently suited to leaded petrol. Availability of leaded and unleaded petrol in filling station throughout the gradual phase out period should be ensured.
- The use of catalytic converters in vehicles that use unleaded petrol to control photochemical seeding.
- Give incentive to encourage change over to the unleaded petrol e.g. differential pricing in favour of the unleaded. The refineries should all be reviewed, equipped and re-engineered to produce the desired unleaded petrol.
- Importation to supplement local production if necessary should be unleaded as far as possible.
- Reliable mass transport system will greatly reduce the number of vehicles on our roads at any given time and therefore emissions.
- Communication systems particularly wire and wireless will greatly reduce travelling within and outside our places of abode and will reduce emission. The GSM cellular phone system is already coming in nicely and should rapidly expand to all nooks and corners to curtail movement and reduce vehicular emissions.

All said and done, we should all endeavour to obey rules and regulations which at present is a let down in all facets of our lives. We all stand to benefit from the proceeds of a healthy environment but we must first cultivate the seeds.

Thank you for your audience and God bless.