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Original Research Article

Assessment of air pollution generated by transport in Owerri, South East, Nigeria

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Abstract

The rapid growth in motor vehicle activity in Owerri municipal and its environs contributes to high level of urban air pollution, among other adverse socioeconomic, environmental, health, and welfare impacts. Vehicular emissions are significant contributors to ambient air pollution, especially in urban areas. This paper reviews the status of vehicle emissions and their health impacts. The implications of emissions such as hydrocarbons, oxides of nitrogen, carbon monoxides, carbon dioxide among others have been discussed. Various methods of effective control of vehicular emissions have also been presented. To achieve this , the trend of vehicles registered within Owerri spanning for a period of ten (10) years were obtained from Imo State Licensing office. This secondary data indicates that the number of registered vehicles has increased tremendously over the years and this rise has significantly increased the vehicular emissions in the study area. Finally, the paper presents preventive measures and sustainable solutions such as vehicle inspection, enforcement of legislations, effective refuse collection and evacuation and steady supply of electricity to stop use of gasoline generators among others to ensure safe environment for the population to live.

Keywords: Carbon dioxide, Health Pollution, Traffic congestion, Vehicular emission

INTRODUCTION

Transportation has become the backbone of accessibility systems, with the growth of economic and social networks over the past two centuries. Individuals, families, entrepreneurs and firms exchange goods and services, interact with people on a regular basis not only for economic life but also for the quality of life. The adverse effects of transportation have a greater impact on the natural and human environment. The fossil fuel combustion associated with transportation results in emissions of pollutants that cause damage to human health, agriculture and sensitive ecosystems, and contribute to global climate change. Transportation can also contribute to the degradation of urban environments, with loss of quality of life and economic productivity from the delays and frustration caused by congestion and stress from traffic noise. Transportation involves the combustion of fossil fuels to produce energy translated into motion. Pollution is created from incomplete carbon reactions, unburned hydrocarbons or other elements present in the fuel or air during combustion. In the process of combustion, a number of gaseous materials and impurities are generated. These combustion by-products are emitted into the environment as exhaust gases. Among the critical pollutants, are nitrogen oxides, carbon monoxides, sulphur dioxide, lead and particulate matters. The Environmental Protection Agency, (EPA) in the United States reports that vehicle emissions account for 51% of carbon monoxide, 34% of Nitrogen oxides and 10% of particulate matter released each year in the US (EPA,2007). The emissions from the vehicles pose serious health threat to humans. It has been asserted that, in developing countries of the world, vehicular

Table 1. Pollutant limit values from the EU Air Quality Directive (2008/50/EC) and WHO guidelines

Pollutant	Averaging period	Concentration EU limit (µg/m^3)	WHO guidelines (µg/m^3)
PM_{10}	24-hour mean	50	50
	Annual mean	40	20
PM2.5	Annual mean	25	10
Ozone	Daily 8-hour mean	120	100
NO2	Hourly mean	200	200
	Annual mean	40	40

Source: European Commission (2008)

growth has been largely unchecked by environmental regulating bodies creating high levels of pollution (Hans, 2006).

The rapid growth in Owerri elicits a range of environmental concerns including air quality. Pollution from mobile sources is exacerbated by inefficient vehicles, disorganized road networks, traffic congestion, and fuel adulteration (Hopkins et al., 2009; Osuji et al., 2009; Assamoi et al., 2010). The oil and gas sector is also a large source of air pollution due to flaring (Ologunorisa, 2001; Osuji and Avwiri, 2005), illegal oil refining (EIA,2012), gas leakage and venting (Hopkins et al., 2009), and frequent pipeline explosions (Minga et al., 2010; Fadeyibi et al., 2011). In the densely populated Niger Delta, where oil and gas extraction is concentrated, carcinogenic polycyclic aromatic hydrocarbon (PAH) concentrations are amongst the highest in the world (Ana et al.,2012). In addition, inadequate electricity distribution results in dependence of industries and households on diesel-powered backup generators (BUGs), kerosene, and fuelwood (Ikeme and Ebohon, 2005; Akinlo, 2009).Statistics on vehicle registration showed an increase from 38,000 to 1.6 million registered vehicles between 1950 and 1992 (Enemari, 2001). Abam and Unachukwu (2009) have also reported that the Federal Road Safety Commission of Nigeria (FRSC) had registered about six million (6,000,000) vehicles between 1999 and 2004 and that 70% of these were cars while 30% were buses and trucks. On the average, these have increased emissions from road transportation in Nigeria. Abam and Unachukwu (2009) studied the concentration of total suspended particles (TSP), nitrogen oxides (NOx), sulphur dioxide (SO_2) and carbon monoxide (CO) in Lagos and Port Harcourt and discovered that the limit recommended for Nigeria had been exceeded. In this study, the TSP concentration for both cities was rather high in comparison to the 24-hour mean of 50 micrograms per cubic meter (µg/m^3) recommended by World Health Organization (WHO). Osuntogun and Koku (2007) assessed the impacts of urban road transportation on the ambient air pollutants, namely CO, SO_2, and NO_2 in three cities in the southwest region in Nigeria: Lagos, Ibadan and Ado- Ekiti. The results obtained for each city exceeded the Federal Ministry of Environment of Nigeria's recommended upper limits of 10ppm, 0.01ppm and 0.04 to 0.06ppm for CO, SO_2, and NO_2 respectively. Abam and Unachukwu (2009) conducted a similar investigation of vehicular emissions in selected areas in Calabar, Nigeria, which indicated that the results of CO, NO_2, SO_2, and PM_{10} were within the range of 3.3-8.7ppm, 0.02 – 0.09ppm, 0.04 – 0.15ppm and 170 - 260µg/m^3 respectively. Table 1 Shows the limit values for the key pollutants.

Ameh, et al(2015) investigated the level of gaseous emissions (CO, NO_2 and SO_2) at four strategic places in Makurdi metropolitan area of Benue State using handheld TO Crowcon Gasman gas meters for a period of one month, during peak periods of traffic flow at the selected locations within the city. The level of emission recorded at the major road junctions in Makurdi showed CO with highest concentration (0.57 - 10.2 ppm), followed by NO_2 (0.01 - 0.11 ppm) and SO_2 (0.00 - 0.1 ppm) in all the sampled sites. ns. The results established that the emission levels in metropolis especially in the afternoon were slightly higher than the Nigerian air quality standard accepted safe limits of 10 ppm for atmospheric CO, 0.04 - 0.06 ppm for NO_2 and 0.1 ppm for SO_2, respectively. These will have adverse health effects and may contribute to climate change, in the long term, if unmitigated.

Oguntoke and Yussuf,(2008) assessed the level of some selected air pollutants which are largely products of internal combustion in motor vehicle engines namely; nitrogen dioxide (NO_2), sulphur dioxide(SO_2), hydrogen sulphide (H_2S), carbon monoxide (CO) and methane (CH_4) in Abeokuta city. Moreover, the health problems suffered by residents living near motorways were also investigated. Number of vehicles was counted at morning, afternoon and evening while gasman auto-sampler (ATEX4 model) was used for monitoring the concentrations of the five gases at the selected motorways in the city. Questionnaire survey was conducted to elicit information about perception of risks and health problems treated by the residents living near motorways. Traffic volume ranged between 792±297 and 2037±70; 641±228 and 2037±95; and 489±169 and 1875±101 at morning, afternoon and evening respectively for the various categories of motorways. The concentrations of CO, SO_2, NO_2, H_2S and CH_4 ranged between 73.72±0.92 and 82.89±3.38; 0,046±0.005 and 0.067±0.017; 0.217±0.02 and 0.399±0.02; 0.167±0.017 and 0.265±0.011; 0.171±0.024 and 0.442±0.385 mg/m3 respectively. There is significant variation ($p > 0.05$) in the volume of traffic and the concentrations of the sampled gases between the periods of the day at the selected motorways. There is also a significant ($p > 0.05$) correlation between traffic volume/density and CO ($r = 0.806$), NO_2 ($r = 0.716$) and H_2S ($r = 0.704$). Hence, traffic volume accounted for 15.5, 49.5, 51.2 and 64.9 percent of CH_4, NO_2, SO_2 and CO concentrations in air sampled along the selected motorways. Health problems suffered and reported to health facilities include cough (56.4%) and breathing impairments (23.6%) among others. Measures that seek to minimize emission of pollutants from automobile are urgently required in cities of the developing countries.

Duru et al, (2015) carried out a study to examine the traffic congestion problems in Owerri urban area of Imo state with the aim of finding out the major causes and possible solutions to the problem in the area. The study made use of both primary and secondary data of field work, oral interview, questionnaire administration, both published and unpublished materials from libraries and internet. A total of 500 copies of questionnaire were administered by a stratified random sampling. Data generated were presented using tables, frequencies and percentages. Analysis of data made use of analysis of variance (ANOVA) and Pearson's product moment correlation coefficient. Two hypotheses were tested at 0.05 or 95 percent confidence limit to authenticate the findings from the generated data. Findings revealed among others that concentration of land use along one axis in Owerri urban accounts for about 56% of the traffic congestion leaving the residual 44% of the causes to other variables. At the end of the study, recommendations were given to improve the situation which includes decentralization of land use in Owerri urban.

Alfred et al , (2013) assessed the vehicle emissions and health impacts in Jos, Plateau state. To achieve this aim, the trend figures of vehicles registered within Jos metropolis spanning for a period of ten (10) years were obtained from Plateau State Board of Internal Revenue (PSBIR), and trend figures of air pollution related-diseases were also obtained for the same period of ten years from three major hospitals in Jos. Three air pollution related-diseases were used as case study (Asthma, Cadiovascular and bronchitis). It was hypothesized that there is no significant relationship between vehicle emissions and human health. The result indicated that as the number of vehicles increases, the incidences of diseases and deaths related to air pollution also increase. Therefore, the study concludes that, there is a significant relationship between vehicle increase, high exposure to vehicle emissions and increase in air pollution related diseases. Recommendations were therefore made toward mitigating the problem on human health and the environment. The pearson product moment coefficient correlation statistical technique was used to test the hopothesis.

Okonkwo et al, (2014) investigated the effect of automobile emission in Port-Harcourt, Rivers State for two weeks. Two locations noted for heavy traffic congestion in the city were chosen for the study. Monitoring times were chosen to capture the traffic congestion. In total, five morning and evening measurement were conducted at each location over the course of two weeks beginning from August 11th – 15th 2010 for garrison intersection and August 18th - 22nd 2010 for slaughter intersection. Concentration measurement for Hydrocarbon (HC) , sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and carbon monoxide (CO) were carried out in the morning (6.30 – 8.00am) and evenings (5.00 – 7.00pm) pea periods of traffic congestion using standard gas monitor (temperature at the time of measurement were noted). Results show that the levels of these gaseous emissions were higher than permissible level on Wednesday to Saturday at the two junctions both morning and evening. However, the level of these gases on Sunday at the two junction in the morning and evening were below detection limit. It imply that these areas are polluted in morning and evening when offices and commercial activities commence.

Okhimamhe (2013) assessed the levels of atmospheric carbon dioxide (CO_2)emission at road junctions in three major cities in the southeast of Niger State in Nigeria, namely: Minna, Bida and Suleja, and identified measures that improve traffic operations while reducing the emission levels that could have implications on global warming, and hence, climate change. On the average, the level of emission of CO_2 recorded at the major road junctions in Suleja, Minna and Bida were 2,856.6ppm, 2,731.1ppm and 2,518.1ppm respectively. The results established that the emission levels in these three cities was approximately eight times more than the internationally accepted safe limits of 350ppm for atmospheric CO_2, but less than the Occupational Safety and Health Administration (OSHA) permissible exposure limits of 5,000ppm which has adverse health effects, and may contribute to climate change, in the long term, if unmitigated.

Okere et al.(2013) the paper reviewed the transportation sector's contribution to local and global air pollution, and the strategic and tactical options available for combating the problem in an environment of sustainable development and economic growth. It also examined the origins of, and the damages caused by, air pollution from transport; it assesses the underlying causes, surveys the principal strategic approaches applied to solving the problem, and examines the various mechanisms of intervention available.

Causes of air pollution from transportation

A number of factors can be identified as influencing the amount of emissions attributable to the transport sector, and an effective strategy will need to take all these factors into account. They include:

Excessive vehicle use

Level of activity or vehicle use is an important factor to take into account in the overall analysis of transportation emissions, particularly in those cases where long-run solutions are envisioned to help avoid the development of a problem. In a number of developed countries (where data and information are more readily available), studies have shown that growth in activity has either significantly increased the amount of CO_2 emitted in the sector or substantially dampened the reduction of CO_2 emissions that would have occurred, the latter because of efficiency improvements during the last three decades of the twentieth century. In the absence of a policy to address vehicle use, growth in vehicle kilometres travelled in developing countries is projected to average between 2.5 and 4 per cent per year between 1990 and 2030.

Age of fleet and technology used

Older vehicles are associated with higher emissions of both global and local pollutants than newer vehicles, both because performance deteriorates as a function of age and because older vehicles are more likely to use obsolete, higher emitting technology.

Poor maintenance of vehicles

Deterioration of emissions characteristics is linked to maintenance practices of owners, particularly for local pollutants, where catalytic exhaust after-treatment technology is used. Misfuelling of catalyst-equipped gasoline vehicles with leaded fuel, even once or twice, can seriously damage the ability of the catalyst to operate properly, and these catalysts can also degrade over time because of other natural contaminants in fuels. Without an effective system in place to ensure that these systems are well maintained, emissions due to neglecting exhaust after-treatment maintenance are likely to increase.

Unavailability or improper use of appropriate fuels

Fuel is a factor for a number of reasons. Regulatory authorities may inappropriately specify fuel types for a given area's conditions, leading to unnecessary emissions of certain kinds of pollutants. Vehicle owners may misfuel, out of ignorance or in response to a poorly established price signal. Finally, dishonest retailers might adulterate or substitute fuels, again often in response to an unfortunate price signal.

Types of Air Pollutants

Carbon monoxide (CO)

Carbon monoxide is an odourless gas formed as a result of incomplete combustion of carbon-containing fuels, including petrol and diesel. Carbon monoxide is readily absorbed from the lungs into the blood stream, which then reacts with haemoglobin molecules in the blood to form carboxyhaemoglobin. Due to human activities such as the combustion of fossil fuels, deforestation, and the increased release of CO_2 from the oceans due to the increase in the earth's temperature), the concentration of atmospheric carbon dioxide has increased by about 35 per cent since the era of industrialization began (Amin, 2009).

Particulate matter

Particulate matter is perhaps the most critical transport –sector pollutant for developing countries in the early part of the twenty-first century, because its effects on human health are significant. The science of particulate matter–both how PM is produced and the mechanism behind how it adversely affects the human body–is complex, controversial and relatively poorly understood at present. In most urban areas, fine PM–particles that are smaller than 2.5 microns and responsible for the bulk of the health impacts of PM –consists primarily of carbon-based and sulphate-based particles, with small amounts of nitrate-based particles and soil dust. Carbon-based, sulphate based, and nitrate-based particles are all produced during combustion, in subsequent atmospheric reactions, and sometimes in catalytic reactions as well.

Volatile organic compounds (VOCs)

The term volatile organic compounds refer to a range of non-methane hydrocarbons (NMHCs) which evaporate at normal surface temperatures. NMHCs are released during combustion because of incomplete burning of the fuel, usually because the flame temperature is too low or the residence time in the combustion chamber is too short. Changes in engine calibration that increase temperatures and residence times will therefore decrease hydrocarbon emissions. VOCs are usually regulated as a class because of their contribution to ozone formation. Ozone seems to impair respiratory function as a short-run response to exposure, but the longer-term effects are less clear; some evidence suggests "reason for concern" (Romieu 1999). The production of ozone in the atmosphere occurs through complex reactions in sunlight of VOCs and oxides of nitrogen (also produced in combustion). Some VOCs also contribute to particulate formation, by coagulating onto soot and other particles, increasing their size and mass. In addition, some VOCs are in and of themselves toxic and hazardous to human health; they include benzene, polycyclic aromatic hydrocarbons, 1,3-butadiene, aldehydes and, through groundwater seepage, methyl tertiary butyl ether (MTBE).

Oxides of nitrogen (NO_x)

Like VOCs, NO_x are of concern both because of their direct effects on human health, and because they react in the atmosphere (with VOCs) to produce photochemical ozone. Nitric oxide (NO) and nitrogen dioxide (NO_2) are released in combustion because molecular nitrogen (N_2) present in the air/fuel mixture splits and is oxidized. The higher the flame temperature or longer the residence time, the more nitrogen available to produce NO_x; consequently, the same technical interventions in engine calibration that might reduce VOCs will increase NO_x. In addition to contributing to ozone formation, NO_x, in particular NO_2, is toxic, impairs respiratory function, and can damage lung tissue.

Oxides of sulphur (SO_x).

Sulphur present in fuel will be released as either sulphate particles, sulphur dioxide (SO_2), or sulphuric acid (H_2SO_4). SO_2 is a major health concern because of its effects on bronchial function, but in cities with high concentrations of ambient SO_2, the contribution of the transport sector tends to be secondary to that of manufacturing and/or electricity production.

Hydrocarbon

Emissions of hydrocarbons indicate low combustion efficiency in internal combustion engines and they arise when vaporised unburned fuel or partially burned fuel products, leave the combustion region and are emitted with the exhaust. Unburned hydrocarbon emissions are independent of air/fuel ratio. They normally arise from shortcomings in the fuel injection system. The level of unburned hydrocarbons in the exhaust gases in generally specified in terms of the total hydrocarbon concentration expressed in parts per million of carbon atoms. The total hydrocarbon emission is a useful measure of combustion inefficiency. Some of these hydrocarbons are nearly inert physiologically and are virtually uncreative from standpoint of photochemical smog. Others are highly reactive in the smog-producing chemistry. Hydrocarbon compounds are divided into non- reactive and re-active based on their potential for oxidant formation in the photochemical smog chemistry. Some hydrocarbons are known carcinogens (Patterson and Henein, 1992).

Lead

Petroleum refiners have historically added tetraethyl lead to gasoline blends to avoid more costly methods of raising octane ratings. However, the costs to society in terms of negative health effects from lead are clear and well-documented. These include cardiovascular disease, premature death, and behavioural and development problems in children. The social costs of lead to megacities in developing countries have been estimated to be over 10times higher than would be the cost to refiners to remove lead from their products. Nevertheless, many parts of the developing world, particularly in Africa, continue to use leaded gasoline. A summary of the quantified and unquantfied health effects of air pollution is presented in table 2.

MATERIALS AND METHODS

The Study Area

The study area is Owerri urban which lies in the Central Business District (CBD) of Imo State. Owerri is the capital of Imo State, South East Nigeria. It is part of the three Local Government Areas: Owerri North, Owerri West and Owerri Municipal. Owerri urban is within the Owerri municipal It is located between 5^0 20'N, 6^0 55'E in the south-western corner and 5^0 34'N, 7^0 08'E in the north-eastern corner meridian (figures 1). The city is bordered on its south by Otamiri River and on its west by Nworie stream. . The area covers the total landmass of 24.88 km. It has mean annual rainfall of 213.2 mm, and mean annual temperature ranging between 26 – 28 ^{0}C, with humidity that varied between 50.5 -70.5 %. Owerri Municipal Council is characterized by influx of people and high volume of vehicular flows in and out of the area. The main indigenous people of Owerri urban are the Amawom, Umuonyeche, Umuodu, Umuoyima, and Umuororonjo, called Owerrinchiise. Imo State has a population of about 3,934,899. (FRN Gazette 2006)

Data Collection

The study was carried out by collecting data of the trend of vehicles registered within Owerri spanning from the year 2000 – 2012, obtained from Imo State Licencing office. Vehicular traffic count and questionnaire survey were collected for this study. Five study locations were carefully selected to include areas with low, medium and high vehicular traffic. The traffic density was determined by directly counting the observed frequency of movement

Table 2. Human health effects of common air pollutants

Pollutants	Quantified health effects	Unquantified health effects	other possible effects their possible effects
Particulate matter /TSP/sulphates	Mortality Chronic and acute bronchitis Minor RAD Chest illness Days of work loss Moderate or worse asthma status	Changes in pulmonary Function	Chronic respiratory diseases other than chronic bronchitis Inflammation of the lung
ozone	Mortality Respiratory RAD Minor RAD Hospital admissions Asthma attacks Changes in pulmonary function Chronic sinusitis and hay fever	Increased airway responsiveness to stimuli Centroacinar fibrosis Inflammation in the Lung	Immunologic changes Chronic respiratory diseases Extrapulmonary effects (changes in the structure or function of the organs)
Nitrogen oxide	Respiratory illness	Increased airway Responsiveness	Decreased pulmonary function Inflammation of the lung Immunological changes
c carbon monoxide	Mortality Hospital admissions – congestive heart failure Decreased time to onset of angina	Behavioural effects Other hospital Admissions	Other cardiovascular effects Developmental effects
sulphur dioxide	Morbidity in exercising asthmatics: Changes in pulmonary function Respiratory symptoms		Respiratory symptoms in non-asthmatics Hospital admissions
lead	Mortality Hypertension Nonfatal coronary heart disease Nonfatal strokes IQ loss	Neurobehavioural function Other cardiovascular diseases Reproductive effects Foetal effects from maternal exposure Delinquent and antisocial behaviour in children	

Source: VTPI (2013)

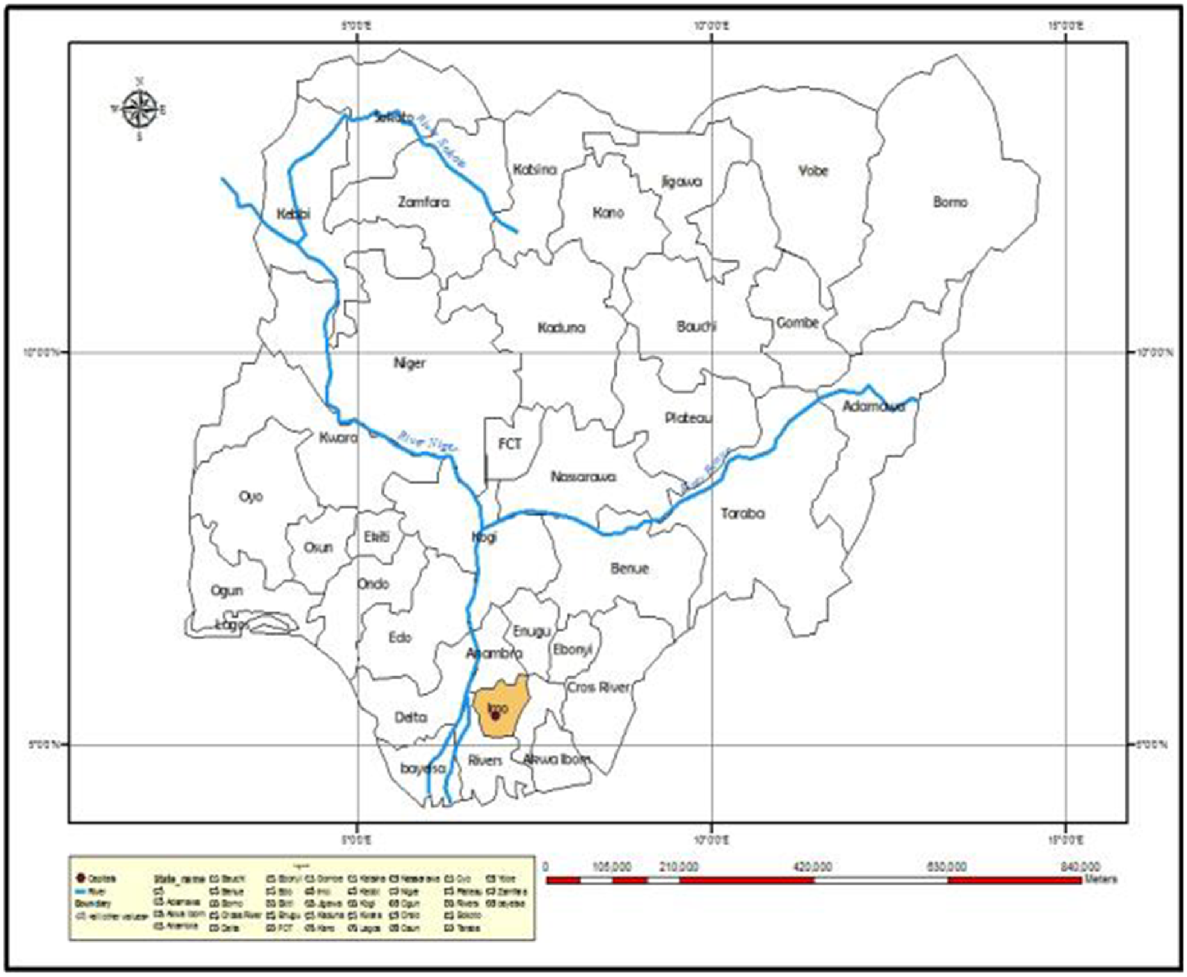

Figure 1. Map of Nigeria showing the location of Imo state

of each vehicle type during the usual peak traffic periods 8:00 a.m. - 10.00 a.m, 12:00 p.m - 2.00 p.m, 4:00 p.m – 6:00 p.m each day for three days. The average number of traffic at each site per hour was calculated as shown in Table 1. A well-structured questionnaire was administered to residents living near motorways to obtain information on their perception of hazards associated with living near motorways and the health problems frequently experienced and treated. Information analysed in this study was collated from 110 respondents with adequate responses out of 120 randomly sampled on the basis of 15 respondents per location. Data generated via these sources were analysed using both descriptive and inferential statistics such as frequency.

RESULTS AND DISCUSSION

The Table 3 is the trend figures of vehicles registered within Owerri, within the period of twelve (12) years. Spanning from 2001 to 2012. The vehicles type registered were Cars, Buses, Lorries, pick-up, Truck and Motor cycles as the commonly used vehicles. From 2001-2012, the total vehicles registered were 41749; 15963; 470: 1452: 231: 69182. The overall total for the twelve (12) years is 129047.

Volume of traffic on some locations in Owerri were determined namely: Douglas Road, Okigwe Road, Port Harcourt Road, Onitsha Road and Wetheral Road. During peak periods, traffic hold up was experienced in some of the areas with long queue of vehicles which results in emission of pollutants. The data collected are shown in table 4.

The data in table 4 shows that in a day the Okigwe Road has a volume of 12483 vehicles, Douglas Road has the highest volume of 22233 vehicles, Wetheral Road has a volume of 13760 vehicles, while that of Portharcourt Road and Onitsha Road is 11623 and 11562 respectively. Traffic volume was highest in the morning, followed by afternoon and evening.

Residents living near motorways (table 5) perceived cough (39.19%), impaired breathing (22.7%), and chest pain/tightness (9.1.9%) as the major health risks associated with living near motorways. These diseases are largely manifestations of lung malfunctioning as a result of exposure to pollutants which enter into the

Table 3. Number of vehicles Registered in Owerri 2001- 2012

Year	Cars	Buses	Lorry	Pick-up	Truck	Motorcycle	Total
2001	901	559	19	253	62	14563	16357
2002	12501	5604	156	863	134	12356	31614
2003	17543	7640	4	165	5	14567	39924
2004	1450	560	24	35	20	5227	7316
2005	1245	430	36	40	3	6550	8304
2006	2756	105	18	19	0	2504	5402
2007	482	156	13	16	0	3110	3777
2008	58	30	0	3	0	1256	1347
2009	65	18	98	0	1	1023	1205
2010	875	300	20	24	0	3560	4779
2011	1023	205	47	10	0	3010	4295
2012	2850	356	35	24	6	1456	4727
Total	41749	15963	470	1452	231	69182	**129047**

Source: Imo state licensing office , 2013

Table 4. Vehicular Traffic on Major Locations in Owerri

	8am -10am	12pm- 2pm	4pm - 6pm	Total
Okigwe Road	4568	2450	5465	12483
Douglas Road	12345	4568	5320	22233
Wetheral Road	5780	3560	4420	13760
Portharcourt Road	3520	2761	5342	11623
Onitsha Road	3685	3450	4427	11562
Total	29898	16789	24974	71661

Table 5. Health problems perceived by residents living near the locations

Received health problems	Frequency	Percentage
Cough	43	39.1
Poor breathing	25	22.7
Chest pain	10	9.1
Cold	11	10
Respiratory tract infection	5	4.5
Malaria	5	4.5
Fever	3	2.7
Dermatitis	2	1.8
Headache	2	1.8
Others	4	3.6
Total	110	100

respiratory tracts as volatile gas, liquid droplets and or particulates. The prevalence of respiratory disorders among roadside residents agrees with the results of other studies that impairment of lung functioning are the most immediate outcome of human exposure to air pollution.

CONCLUSION AND RECOMMENDATIONS

From this study, vehicular emissions contribute significantly to urban air quality. Health risks associated with continuous exposure of humans to gaseous pollutants emanating from vehicle exhaust are largely impairment of respiratory system. In order to minimize the problems of gases emitted by automobiles, the developing countries should ensure that imported vehicles and those locally assembled meet emission standard. Moreover, programme should be put in place to establish enforceable standards for permissible levels of vehicle emissions. Such standard will be used to screen vehicles already in use to determine their road worthiness and check emission level. Functional and effective public-mass transportation programme/scheme must be pursued with high sense of commitment so as to reduce the volume of private cars in urban centres.

Traffic volume in some busy locations within the city should be minimized through the creation of alternative roads to ease off congestions. It will be appropriate for authorities in the developing countries to source alternative energy for automobile use other than fossil fuel. The use of simple and cheap nose mask should be introduced to workers whose jobs require staying several hours near motorways.

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