Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.4, No.21, 2014

Impacts of Traffic Volumes on Air Quality in Uyo Urban, Akwa Ibom State, Nigeria.

[1] Patrick Etim Apkan, [2] Edidiong Elijah Usip, [3] Uduak Okon Jeremiah
1. Urban and regional planning, School of Environmental Studies, Akwa Ibom State polytechnic Ikot Osurua Nigeria
+2348067040667
e_patrickapan@yahoo.com#
2. Urban and regional planning, School of Environmental Studies, Akwa Ibom State polytechnic Ikot Osurua Nigeria

3. Estate Management, School of Environmental Studies Akwa Ibom State polytechnic, Ikot Osurua Nigeria
08032939003
UduakJeremiah2020@yahoo.com
*Email of the corresponding author: edidiong.usip@yahoo.com

Abstract:
Anecdotal evidence suggests that motor vehicle emissions constitute a major source of atmospheric pollution in Uyo Urban. In the current study, major air pollutants (Carbon Monoxide, Nitrogen Oxides, Sulphur Oxides and SPM) were sampled in Twenty one location points. Samples were taken at three different time intervals of the day corresponding to morning peak, evening peak and afternoon off-peak periods. Using regression analysis and GIS, spatio-temporal and linear relationships between the pollutants and volume of vehicular movement were analysed. The result is a spatial surface pollution map reflecting pollution concentration in each point in the study area. The four major pollutants were detected at all times and locations while the concentration of CO and NO2 showed a mean concentration level greater than the Federal Environmental Protection Agency limits and the recommended municipal (local) standard. This was predominantly during morning and evening peak. Though this study did not cover all the traffic junctions in the whole city of Uyo Urban, findings from the twenty one sampling points suggest that the city is under the threat of traffic related pollution and is possibly more susceptible further pollution given increasing population influx and vehicular traffic. Improved road network and construction of modern roundabouts could help reduce peak period traffic in the nearest future.

Keywords: Traffic volumes, air quality, air pollution, vehicular emission

Introduction

Air pollution is any atmospheric condition in which certain substances are present in such concentrations and duration that they may produce harmful effects on man and his environment. Common air pollutants include carbon monoxide, nitrogen oxide, sulphur dioxide, lead and Total Suspended Particulates (TSP), the latter being the most widespread and the most serious for human health. The major sources of air pollutants are man's industrial manufacturing and motor vehicle operation activities, both of which are concentrated in urban areas, where also the bulk of the World's population lives. Available data shows that the air quality in most major cities of the World has deteriorated to levels that make air quality management strategies necessary. The effects of this traffic emissions on respiratory health, and growing pressures for policy and management action to reduce air pollution levels, have highlighted the need for improved methods of mapping traffic related pollution in urban areas both for exposure assessment and policy support. Vehicular emission remains a threat to environmental health problem which is expected to increase reasonably as vehicle ownership increases in the world. Over 600 million people globally are exposed to hazardous level of traffic generated pollutants (UN 1989; Abam and Unachuku, 2009. Some of the worst pollutants, and those that are closely monitored in the United States, are nitrogen oxides, carbon monoxide, sulfur dioxide, lead, and particulate matter. According to the Environmental Protection Agency (USEPA, 2007), vehicles account for 51% of carbon monoxide, 34% of nitrogen oxides and 10% of particulate matter released each year in the US. Clearly, vehicular emissions are a major source of ambient air pollution that must be controlled if air quality is going to be maintained. Schwela, (2000), concluded that many studies have confirmed adverse health effects associated with high concentrations of transport-related pollutants. Air pollution concentrations vary widely depending on the sources of pollution and their distribution, meteorological conditions and the topographical features in the vicinity. The amount of pollutant in the air is expressed in terms of its mass/volume concentration, usually as micrograms of pollutant per cubic metre of air (µg/m3). It is reasonable to expect that, as vehicle-kilometers-traveled increase, ambient air pollution concentrations also increase. Pollutants emitted by motor vehicles impact the spatial and temporal distribution of ambient concentrations, which are also determined by meteorological circumstance, such as wind direction (Faiz, 1993). However, the quantitative relationship between pollution concentrations and traffic volumes has rarely been investigated. In this research, peak interval traffic volumes around air quality monitoring stations are estimated and the relationships between monitored pollution concentrations and these traffic volumes are examined.

Research method and data collection

The data collection, which consists of the traffic flow survey and the environmental survey, was conducted on July l2-15, for four working days in 2013 at, 21 locations throughout Uyo Urban Area (Figure 2.2, Table I.1 and Table 1.2). The traffic flow survey involved the observation and collection of traffic flow data from 21 intersections points along major arterial roads using 8-mm video cameras and direct counting method. The time periods of taking measurements of data from the selected sites was carried out in three (3) time periods for duration of four working days of the week. These times are as follows:

- 7.30 am – 10.30 am Morning peak hours
- 1.00 pm – 3.00 pm off peak period
- 5.00 pm – 8.00 pm Evening peak hours

This research involved the collection of data on the following air quality parameters: Carbon Monoxide (CO), Nitrogen Oxides (NO_2), Sulphur Oxides (SO_2), and solid particulate matters (SPM). The climatic elements sampled were the ambient temperature (oC), relative humidity (%), and wind velocity (ms-1). Air quality parameters were measured using the Gasman auto sampler (MX6 model) Emission Analyzer and particulate monitor, which is an automatic instrument that measures CO, NO_2, SO_2, and SPM, temperature and differential pressure as well as the wind velocity and direction. The wind velocity value was obtained using the Kestrel 4000 weather tracker. Global Positioning System (GPS) was used in taking coordinates of the sampling locations. Data were presented graphically and in tables, while further analysis was based on descriptive and explanatory (inferential) statistics. The descriptive statistics included measures of central tendency and variation (dispersion). The inferential statistical tool used in this work was the Simple regression Analysis.

Geographical Setting of Uyo Urban

The study area, Uyo capital, is located between latitude $4^{o}52^{I}$N and $5^{o}07^{I}$ North of the equator and longitude 7^{o}47E to 8^{o} 03E of Greenwich Meridian. The land mass is approximately 28.48km^2 and is situated about 55km inland from the Atlantic coast. The area is bounded on the North by Ikono, Ibiono and Itu Local Government. On the south it is bounded by Ibesikpo Asutan Nsit Ibom and Etinan Local Government Areas, is bounded on the West by Abak Loca Government Area as shown in (fig.2.1 below). This study is however interested in all those major road intersections within Uyo capital city which are prone to traffic congestion. Consequently, all major road intersections and roundabouts were covered in the study area.

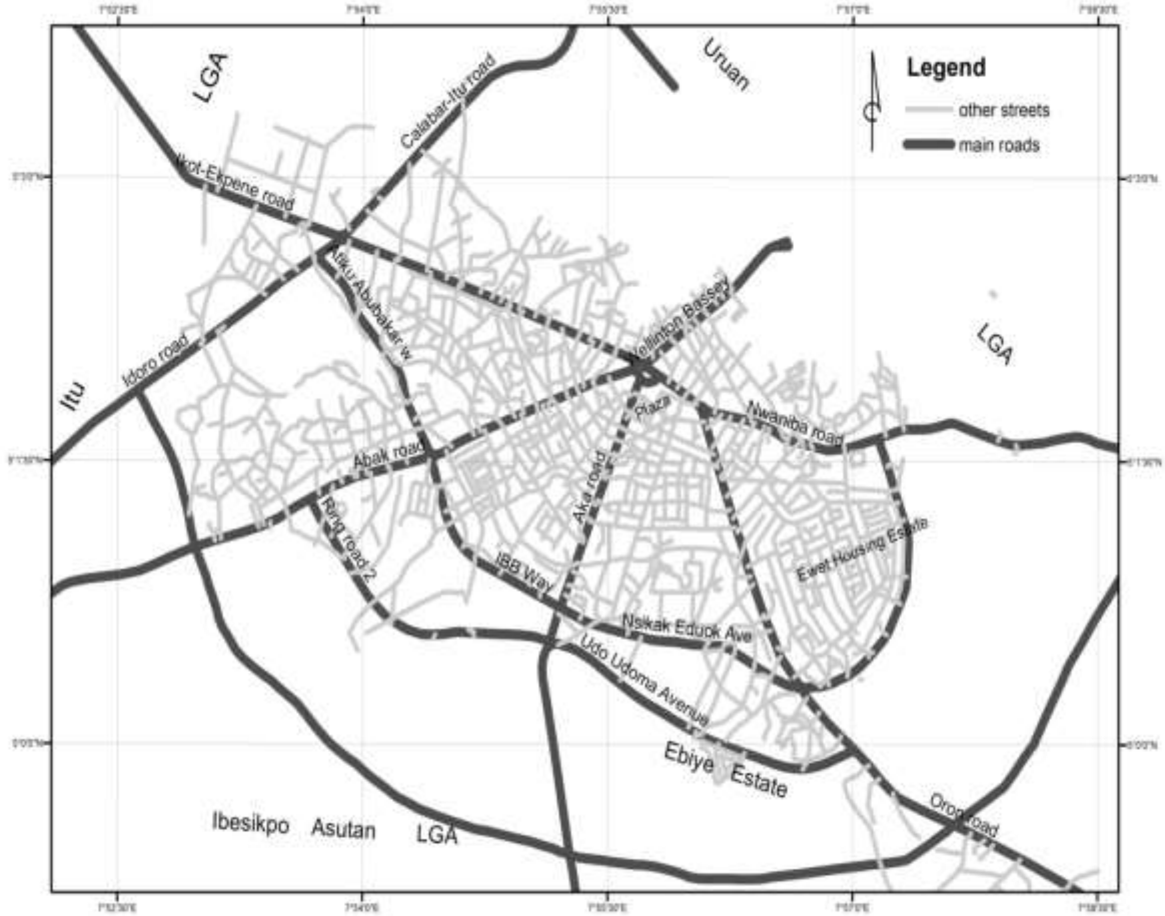

FIG 2.1 SHOWING STUDY LOCATION

TABLE i: Vehicle traffic flow along sample streets in uyo urban volume/time

S/N	STREET/ROAD	X Lat.	Y Long.	MORNING PEAK (7:30-10:30)	EVENING PEAK (4:30-6:30)	OFF PEAK (11:30-2:30)
SP1	ABAK ROAD BY PLAZA	$05^{0} 01^{1} 56.5^{11}$	$007^{0} 55^{1} 15.2^{11}$	3,386	2063	2238
SP2	IK. ROAD BY PLAZA	$05^{0} 02^{1}\ 0.6^{11}$	$007^{0} 55^{1} 42.1^{11}$	5,818	4377	1210
SP3	AKA ROAD BY PLAZA	$05^{0} 01^{1} 59.6^{11}$	$007^{0} 55^{1} 40.5^{11}$	3386	4097	2738
SP4	IK.BY AKCT/UNIUYO ANEX	$05^{0} 02^{1} 19.8^{11}$	$007^{0} 54^{1} 59.7^{11}$	3382	3449	2808
SP5	UDOBIO BY ABAK ROAD	$05^{0} 01^{1} 56.5^{11}$	$007^{0} 55^{1} 15.2^{11}$	2849	2884	2558
SP6	UKANA OFFOT BY ABAK ROAD	$05^{0} 00^{1} 03.0^{11}$	$007^{0} 54^{1} 46.7^{11}$	2823	2438	2820
SP7	SECRETARIAT JUNCTION BY ABAK ROAD	$05^{0} 01^{1} 34.8^{11}$	$007^{0} 54^{1} 20.0^{11}$	6409	6439	5334
SP8	ABAK ROAD BY UNIUYO TEACHING HOSPITAL	$05^{0} 00^{1} 36.2^{11}$	$007^{0} 51^{1} 41.0^{11}$	1542	2429	1391
SP9	EKOM IMAN JUCTION ALONG ABAK ROAD	$05^{0} 00^{1} 21.6^{11}$	$007^{0} 51^{1} 18.6^{11}$	3680	2991	2509
SP10	AKA ROAD BY IBB AVANUE	$05^{0} 01^{1} 36.2.^{11}$	$007^{0} 51^{1} 41.0^{11}$	4384	4677	2834
SP11	ORON ROAD BY GIBB STREET	$05^{0} 01^{1} 54.1^{11}$	$007^{0} 55^{1} 55.4^{11}$	4856	4228	3204
SP12	ORON ROAD BY UDOTUNGUBO Y- JUNCTION	$05^{0} 01^{1} 34.3^{11}$	$007^{0} 56^{1} 07.6^{11}$	2843	2468	2154
SP13	ORON ROAD URUAN STREET	$05^{0} 00^{1} 34.3^{11}$	$007^{0} 56^{1} 37.0^{11}$	1720	2129	1657
SP14	ORON ROAD NSIKAK EDOUK/EDET AKPAN AVENUE	$05^{0} 00^{1} 23.5^{11}$	$007^{0} 56^{1} 37.0^{11}$	2073	2102	1825
SP15	ORON ROAD BY UDOUDOMA	$05^{0} 00^{1} 03.0^{11}$	$007^{0} 56^{1} 56.6^{11}$	2143	2069	1933
SP16	ORON ROAD BY MBIABONG PARK	$05^{0} 00^{1} 48.9^{11}$	$007^{0} 55^{1} 09.4^{11}$	2945	3142	2216
SP17	NWANIBA BY BEN UDO STREET	$05^{0} 01^{1} 38.0^{11}$	$007^{0} 56^{1} 54.0^{11}$	3622	3496	2472

SP18	NWANIBA BY EKPRI NSUKARA T-JUNCTION	$05^{0} 01^{1} 42.9^{11}$	$007^{0} 58^{0} 00.3^{11}$	2843	3428	2116
SP19	NWANIBA BY USE PRIMARY SCHOOL	$05^{0} 01^{1} 36.4^{11}$	$007^{0} 58^{0} 41.9^{11}$	2183	2422	2112
SP20	UDOUMANA BY OBIO-IMO STREET	$05^{0} 01^{1} 14.5^{11}$	$007^{0} 55^{1} 39.3^{11}$	2921	3242	2186
SP21	ORON ROAD BY ST. JAMES AFRICAN PRIMARY SCHOOL	05 00’ 583’’	007 56’ 19.4’’	2173	2342	1963

AUTHOR’S FIELD SURVEY, 2013

TABLE ii: Vehicular traffic flow along sample streets in uyo urban

S/N	STREET/ROAD	STREET AREA (M^2)	TRAFFIC FLOW	NUMBER OF VEHICLE CONCENTRATION/UNIT PEAK
SP1	ABAK ROAD BY PLAZA	7.3	7687	1053
SP2	IK. ROAD BY PLAZA	8.6	11405	1326
SP3	AKA ROAD BY PLAZA	10.8	10221	1022
SP4	IK.BY AKCT/UNIUYO ANEX	8.3	9539	1161
SP5	UDOBIO BY ABAK ROAD	7.3	8291	1136
SP6	UKANA OFFOT BY ABAK ROAD	7.3	8081	1106
SP7	SECRETARIAT JUNCTION BY ABAK ROAD	12.5	18182	1454
SP8	ABAK ROAD BY UNIUYO TEACHING HOSPITAL	7.3	5363	734
SP9	EKOM IMAN JUCTION ALONG ABAK ROAD	8.6	9180	1067
SP10	AKA ROAD BY IBB AVANUE	10.8	11895	1101
SP11	ORON ROAD BY GIBB STREET	8.3	12288	1480
SP12	ORON ROAD BY UDOTUNGUBO Y- JUNCTION	7.5	7465	995
SP13	ORON ROAD URUAN STREET	7.6	5506	724
SP14	ORON ROAD NSIKAK EDOUK/EDET AKPAN AVENUE	8.4	6000	714
SP15	ORON ROAD BY UDOUDOMA	8.4	6145	731
SP16	ORON ROAD BY MBIABONG PARK	7.5	8303	1186
SP17	NWANIBA BY BEN UDO STREET	8.0	9590	1198
SP18	NWANIBA BY EKPRI	9.0	8811	979

	NSUKARA T-JUNCTION			
SP19	NWANIBA BY USE PRIMARY SCHOOL	8.0	6720	840
SP20	UDOUMANA BY OBIO-IMO STREET	8.2	8349	1018
SP21	ORON ROAD BY ST. JAMES AFRICAN PRIMARY SCHOOL	7.6	6449	852

AUTHOR'S FIELD SURVEY, 2013

TABLE iii: Average emission estimates at morning peak (7:30 – 10:30) 2013

S/N	Street Area(m^2)	Traffic flow per peak	Vehicle Concentration/ Area Per peak	Meteorology					Air Quality Parameters			
				Temp.	R/H	Pressure	Wind direction	Wind Speed	NO_2 (ppm)	SO_2 (ppm)	CO. (ppm)	SPM (ppm)
3z	7.3	7687	1053	25	64	732	11^0 SE	0.5	0.1	0.1	2.0	0.2
SP2	8.6	11405	1326	25	61	731	16^0 NE	0.3	0.1	0.3	6.0	0.3
SP3	10.8	10221	1022	25	61	731.1	11^0 SW	0.3	0.3	0.3	6.0	0.3
SP4	8.3	9539	1161	27	55	728.5	4^0 NE	0.4	0.3	0.3	7.0	0.4
SP5	7.3	8291	1136	26	63	731	11^0 NE	0.4	0.2	0.3	5.0	0.3
SP6	7.3	8081	1106	26	62	731	16^0 NE	0.4	0.2	0.3	6.0	0.2
SP7	12.5	18182	1454	25	60	732	10^0 NE	0.6	0.4	0.4	7.0	0.5
SP8	7.3	5363	734	25.5	63.5	730.5	16^0 SW	0.4	0.3	0.2	8.0	0.5
SP9	8.6	9180	1067	25	62	732	90^0 NE	0.3	0.3	0.4	7.0	0.6
SP10	10.8	11895	1101	28.5	56.5	728	16^0 SE	0.4	0.4	0.4	7.0	0.5
SP11	8.3	12288	1480	24.5	64	732	12^0 W	0.4	0.4	0.4	7.0	0.7
SP12	7.5	7465	995	27.5	53	729	7^0 NE	0.5	0.1	0.3	7.0	0.2
SP13	7.6	5506	724	27.5	53	729	14^0 SE	0.4	0.2	0.3	5.0	0.3
SP14	8.4	6000	714	28.5	53	720	14^0 SE	0.4	0.2	0.1	5.0	0.3
SP15	8.4	6145	731	29	51	722	22^0 SE	0.3	0.1	0.4	6.0	0.3
SP16	7.5	8303	1186	27	51.5	729.5	32^0 N	0.4	0.1	0.1	6.0	0.2
SP17	8.0	9590	1198	28	54	729	27^0 SW	0.3	0.3	0.3	5.0	0.4
SP18	9.0	8811	979	28.5	53	729	24^0 SW	0.4	0.2	0.3	7.0	0.4
SP19	8.0	6720	840	28	54	728.5	33^0 NW	0.5	0.2	0.2	7.0	0.2
SP20	8.2	8349	1018	30	55	728	31^0 NW	0.5	0.2	0.3	8.0	0.3
Sp21	7.6	6449	852	28	53	729	27^0 W	0.3	0.1	0.2	4.0	0.3
MEAN									0.25	0.33	6.28	0.333
STAN. DEV.									0.22	0.32	0.90	0.12

AUTHOR'S FIELD SURVEY, 2013

TABLE iv: Average emission estimate/weather data at afternoon (off peak) 11:30 – 2:30

S/N	Street Area(m^2)	Traffic flow per Peak	No. Of Vehicle Concentration Per Unit Area Per peak	Meteorology					Air Quality Parameters			
				Temp.	R/H	Pressure	Wind Direction	Wind Speed (m/s)	NO_2 (ppm)	SO_2 (ppm)	CO. (ppm)	SPM (ppm)
SP1	7.3	7687	1053	27	61	730	15^0 SE	0.5	0.3	0.2	0.5	0.5
SP2	8.6	11405	1326	28.5	51	731	15^0 SE	0.6	0.2	0.1	0.3	0.3
SP3	10.8	10221	1022	27.5	55	730	15^0 SE	0.2	0.2	0.1	0.2	0.2
SP4	8.3	9539	1161	29.5	50	727	17^0 SE	0.3	0.2	0.2	0.3	0.3
SP5	7.3	8291	1136	26	61	730.1	12^0 SE	0.3	0.2	0.2	0.4	0.2
SP6	7.3	8081	1106	26	60	730.1	12^0 SE	0.3	0.2	0.2	0.4	0.3
SP7	12.5	18182	1454	27	58	730	9^0 SE	1.1	0.3	0.2	0.5	0.4
SP8	7.3	5363	734	27	62	730	8^0 NE	0.3	0.2	0.1	0.3	0.2
SP9	8.6	9180	1067	29	51.5	730.5	8^0 NE	1.0	0.2	0.1	0.2	0.2
SP10	10.8	11895	1101	30	50	727	15^0SE	0,3	0.1	0.1	0.2	0.3
SP11	8.3	12288	1480	27	54	729	16^0 S	0.4	0.2	0.2	0.1	0.2
SP12	7.5	7465	995	29	52.2	728	31^0 N	0.3	0.2	0.1	0.1	0.2
SP13	7.6	5506	724	28.5	54	728	31^0 W	0.4	0.1	0.1	0.2	0.3
SP14	8.4	6000	714	30.5	44	728.5	14^0 SE	0.3	0.1	0.1	0.3	0.2
SP15	8.4	6145	731	32.5	39	728.5	22^0SW	0.3	0.1	0.1	0.1	0.2
SP16	7.5	8303	1186	33	46	729	20^0 SW	0.2	0.1	0.2	0.2	0.2
SP17	8.0	9590	1198	29	54	728	23^0 SW	0.3	0.3	0.3	0.4	0.3
SP18	9.0	8811	979	29	54	728	33^0 NW	0.4	0.1	0.2	0.1	0.2
SP19	8.0	6720	840	29.5	52	728	30^0 NW	0.3	0.2	0.1	0.3	0.3
SP20	8.2	8349	1018	27	50	727	17^0 SE	0.3	0.1	0.2	0.3	0.2
Sp21	7.6	6449	852	28.5	51	727	22^0 SW	0.3	0.1	0.2	0.3	0.2
MEAN	7.3	7687	1053						0.15	0.13	0.25	0.25
S.DV.									0.05	0.04	0.10	0.08

AUTHOR'S FIELD SURVEY, 2013

TABLE V AVERAGE EMISSION ESTIMATE/WEATHER DATA AT EVENNING PEAK (4:30 – 7:30)

STANDARD LOCATIONS	Street Area(m^2)	Traffic flow per hour	No. Of Vehicle Concentration Per Unit Area Per Hour	Meteorology					Air Quality Parameters			
				Temp.	R/H	Pressure	Wind Direction	Wind Speed (m/s)	NO_2 (ppm)	SO_2 (ppm)	CO. (ppm)	SPM (ppm)
SP1	7.3	7687	1053	27	61	730	15^0 SE	0.5	0.4	0.3	8.0	0.5
SP2	8.6	11405	1326	28.5	51	731	15^0 SE	0.6	0.3	0.2	6.0	0.3
SP3	10.8	10221	1022	27.5	55	730	15^0 SE	0.2	0.2	0.3	7.0	0.4
SP4	8.3	9539	1161	29.5	50	727	17^0 SE	0.3	0.2	0.3	8.0	0.3
SP5	7.3	8291	1136	26	61	730.1	12^0 SE	0.3	0.2	0.2	8.0	0.4
SP6	7.3	8081	1106	26	60	730.1	12^0 SE	0.3	0.2	0.2	6.0	0.3
SP7	12.5	18182	1454	27	58	730	9^0 SE	1.1	0.5	0.4	9.0	0.5
SP8	7.3	5363	734	27	62	730	8^0 NE	0.3	0.2	0.2	7.0	0.4
SP9	8.6	9180	1067	29	51.5	730.5	8^0 NE	1.0	0.2	0.3	8.0	0.3
SP10	10.8	11895	1101	30	50	727	15^0 SE	0,3	0.2	0.2	7.0	0.4
SP11	8.3	12288	1480	27	54	729	16^0 S	0.4	0.2	0.2	7.0	0.3
SP12	7.5	7465	995	29	52.2	728	31^0 N	0.3	0.2	0.2	6.0	0.3
SP13	7.6	5506	724	28.5	54	728	31^0 W	0.4	0.1	0.1	5.0	0.5
SP14	8.4	6000	714	30.5	44	728.5	14^0 SE	0.3	0.1	0.2	6.0	0.5
SP15	8.4	6145	731	32.5	39	728.5	22^0SW	0.3	0.2	0.2	7.0	0.4
SP16	7.5	8303	1186	33	46	729	20^0 SW	0.2	0.2	0.1	6.0	0.3
SP17	8.0	9590	1198	29	54	728	23^0 SW	0.3	0.3	0.4	9.0	0.4
SP18	9.0	8811	979	29	54	728	33^0 NW	0.4	0.2	0.2	3.0	0.4
SP19	8.0	6720	840	29.5	52	728	30^0 NW	0.3	0.2	0.2	6.0	0.3
SP20	8.2	8349	1018	27	50	727	17^0 SE	0.3	0.2	0.2	4.0	0.4
Sp21	7.6	6449	852	28.5	51	727	22^0 SW	0.3	0.1	0.2	6.0	0.4
MEAN									0.18	0.20	6.52	0.37
STAN. DEV.									0.04	0.04	1.47	0.07

AUTHOR'S FIELD SURVEY, 2013

	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	SP10	SP11	SP12	SP13	SP14	SP15	SP16	SP17	SP18	SP19	SP20	SP21	M	WHO	USPA
NO_2	1.2	1.4	1.3	1.4	1.6	1.6	1.3	1.6	1.5	1.6	1.4	1.3	1.3	1.1	1.1	1.1	1.1	1.2	1.3	1.2	1.4	**0.2**	0.053	0.04–0.06
SO_2	1.8	2.1	1.8	1.9	1.7	1.7	1.3	1.4	1.8	1.8	1.8	1.8	1.4	1.4	1.4	1.4	1.6	1.3	1.5	1.4	1.6	**0.2**	0.03	0.01
CO	32.5	29.6	30.42	26.5	25.48	23.55	22.66	18.6	20.67	18.67	20.64	28.44	24.44	17.34	21.30	16.44	19.57	19.31	16.45	16.45	17.44	**4.3**	35	10-20
SPM	0.37	1.1	1.14	1.8	1.7	1.7	2.2	1.71	1.62	1.52	2.3	1.5	0.72	0.3	1.01	1.61	1.01	1.13	1.8	2.2	1.72	**0.3**	0.053	0.04–0.06
Tem. (C)	27	27	26	27	29	27	26	26.5	26	27	27	27	26	27.6	28.5	27.5	27	27	26	27	28			
Rel. (%)	58	54	62	51.5	6.0	62	61	62	63	61	61	62	54	54	58	55	55	54	61	62	61			
WS	0.3	0.3	0.3	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.2	0.3	0.4	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.4		

Fig. vi: The Results of average diurnal pollutants emission

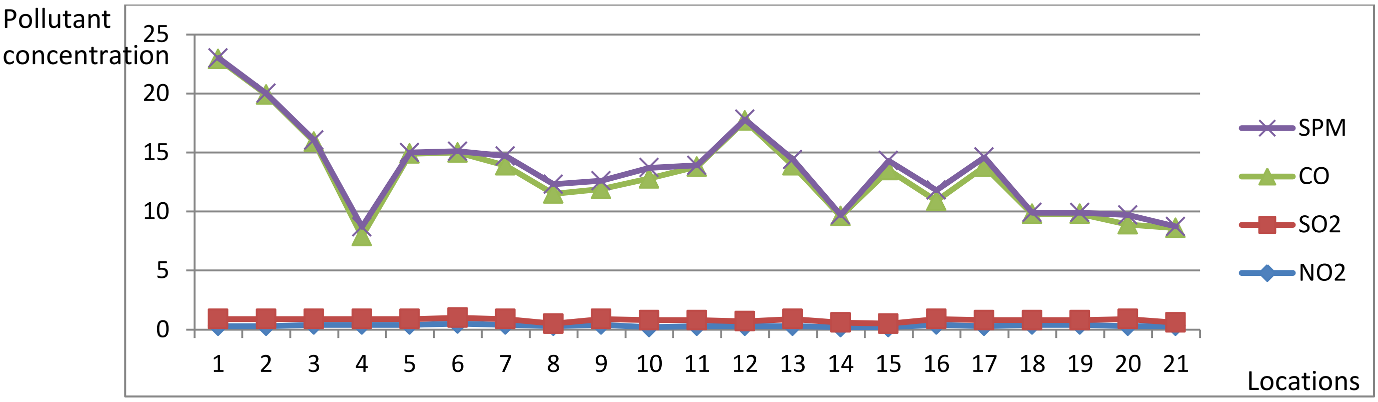

Fig .2.2 AVERAGE DIURNAL POLLUTANT DISTRIBUTIONS ALONG SAMPLE STREETS IN UYO URBAN

Relationship of traffic flow volumes and roadside Pollutant concentration

The relationships of the measured roadside CO, SO_2, SPM and NO_2, mass concentration and all traffic passing through the intersections are shown in the table 1.3 below and Figure 1.3a-1.3c respectively. The measurement time for the pollutant, is peak hours intervals that similarly corresponds to 24-hour traffic flow passing through the section. The p-value for all the pollutants is <0.05 signifying high spatial correlationship as in the table below.

Table 1.3: Correlation coefficients for relationship between air quality parameters and Traffic Volumes

Coefficients	Parameters			
	NO_2	SO_2	CO	SPM
R	0.814	0.892	0.896	0.734
R2 (%)	0.662	0.796	0.803	0.539
F	37.217	74.048	77.594	22.216
Sig F	0.000	0.000	0.000	0.000

Source: Analysis of fieldwork data, 2014

Fig. 2.4 Spatial distribution of SO_2 incidence due to due traffic

FIG. 5.13 SPATIAL DISTRIBUTION OF DAILY NO2 DUE TO VEHICULAR TRAFFIC

Fig. 2.5 Spatial distribution of SO_2 incidence due to due traffic

Figure 1.2 above is the result of interpolation and overlay analysis to gather more information about the Daily incidence of pollutants in the area. The maps were obtained by zooming into part of the state, after overlaying the route network map on the area. With these maps, decision and policy makers can identify areas of high pollutants concentration.

Traffic volumes impacts on pollution concentrations

Several studies have uncovered meaningful relationships between vehicle emissions and air pollution concentrations (Roorda-Knape et al., 1999; Potoglou and Kanaroglou, 2005; Kim and Guldmann, 2007; Lau et al., 2008). In addition, and Guldmann (2008) find a significant relationship between annual average pollution.

Conclusion

Air pollution and its major adverse effects on human health and the environment are concisely explained in this paper. The protection of environment is one of the most important problems facing us today. It convinces about the necessity of air quality management, especially in urban areas where pollution sources and human population are concentrated. It has accounted briefly on the relationships between peak hour interval traffic volumes around AQMs and four air pollutants concentrations (NO_2, SO_2, CO, and SPM). Finally, the peak traffic volumes have positive relationships with NO_2, SO_2, CO, and SPM concentrations. This study has shown that the levels of these pollutants are above the recommended levels of United States Environmental Protection Agency (EPA), and WHO in most parts of the city, indicating a need for a regular air quality monitoring and management system. Reliable and robust strategies for keeping pollution caused by harmful chemicals under safe level have to be developed and used routinely.

Recommendations

The following recommendations have been made to address the situation at hand in the study area:

1. Improvement in the condition of inner roads to reduce the number of vehicles at major Intersections will help reduce the concentration of pollutants if there is no serious traffic situation in a particular area at every point in time there should be public and consumer awareness campaigns about the havoc of environmental degradation.

2. Government should set a high standard for the importation of used vehicles.
3. Exhaust Emission Standards should be set by FME and should enforce these standards to ensure strict compliance.
4. Old vehicles should be mandated to use exhaust reactors i.e. catalytic converters and thermal reactors.
5. Regular assessment of the actual level of pollution in the country by the appropriate agencies.
6. Vehicle inspection centres should be introduced. The centres should be equipped to test and certify compliance or otherwise of all automobiles used in the country, especially in the urban areas.
7. Government should impound a vehicle that violates emission standards.
8. Research on renewable energy sources should be encouraged and funded to ensure sustainable environment.

References

Abam F. I. and Unachukwu G. O. (2009) "Vehicular Emissions and Air Quality Standards in Nigeria". European Journal of Scientific Research Vol.34 No.4 (2009), pp.550-560.

Bohler, T., K. Karatzas, G. Peinel, T. Rose, and R. San Jose (2002). Providing Multi-modal Access to Environmental Data–customizable Information Services for Disseminating Urban Air Quality Information in APNEE. Computers, Environment and Urban Systems 26, pp. 39- 61.

Faize, A., Sturm, P. 2000. New Directions: Air Pollution and Road Traffic in Developing Countries. Atmospheric Environment. 34(27): 4745-4746.

Jensen, S.S., R. Berkowicz, H.S. Hansen, and O. Hertel (2001). A Danish decision-support GIS Tool for management of urban ai quality and human exposures. Transportation Research Part D. Vol. 6, pp. 229-241.

Kim, Y. and J.M. Guldmann (2008). A GIS-Based Analysis of Traffic-Related Air Pollution in Seoul, Korea, Transportation Research Record, submitted for publication

Potoglou, D. and P.S. Kanaroglou (2005). Carbon Monoxide Emissions from Passenger Vehicles: Predictive Mapping with an Application to Hamilton, Canada. Transportation Research Part D 10, pp. 97-109.

Roorda-Knape, M.C., N.A.H. Janssen, J. de Hartog, P.H.N. Von Vliet, H. Harssema, and B. Brunekreef (1999). Traffic Related Air Pollution in City Districts Near Motorways. The Science of the Total Environment 235, pp. 339-341.

Schwela, D. (2000), Air Pollution and Health in Urban Areas. Reviews on Environmental Health.2000.15(12): 13-24.

USEPA (2007). Permit Guidance Manual on Hazardous Waste Land Treatment Demonstration. Final draft EPA – 530 /SW 86 -032. Office of solid waste and emergency responses USEPA, Washington D.C.