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Air Quality in Obrikom /Omoku Industrial Area and Public Health Concerns

NWOGBIDI, K.C.[1], HART, A. I.[2], NDUKWU, B. C.[3], FRANKLIN OKORO[4]
[1]*Institute of Natural Resources Environment and Sustainable Development, University of Port Harcourt, Nigeria*
[2]*Department of Animal & Environmental Biology, University of Port Harcourt, Nigeria*
[3]*Department of Plant & Biotechnology, University of Port Harcourt, Nigeria*
[4]*CLEANSCRIPT GROUP*

Abstract: *Ambient air quality of the Rivers State Industrial Area at Omoku/Obrikom, ONELGA, Rivers State was carried out by carrying out in-situ measurement of the levels of gases and volatile organic acids in three site (SS1 – SS3) located within the IPS facility and a control (SS4) outside. Measurement was carried out using standard instruments (aeroqual, 500 series) with different sensors from January to April 2019. Result indicate that the mean levels in parts per million (ppm) of the gases at the turbine area (SS3) were higher than other sites. Perceived impacts of bad air quality included breathing problems and irritation. Observed values were compared with standard values stipulated by Federal Environmental Protection Agency (FEPA) to investigate the level of appliance to environmental air quality.*

Keywords*: Air quality, pollution, emission, public health*

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I. Introduction

Air quality is a major concern throughout the world and one of the basic necessities and requirement of human existence (Hassan et al., 2012). Poor air quality arising as a result of atmospheric pollutants such as smoke stacks of fossil fuel power stations released at high concentration from anthropogenic activities and natural events (volcano) poses serious damage to public health, the environment and development as it is responsible for increasing breathing problems (Rai et al., 2011). As air quality declines, the risk of cough asthma, wheezing, lung cancer, heart diseases, chronic and acute respiratory and cardiovascular diseases increases for inhabitants of the affected area wreaking havoc on the population.

Waste deposition in landfills which generate methane (CH4) may form explosive mixtures with air, displace oxygen in an enclosed space which may result to suffocation if reduced below 19.5%. Gases such as carbon dioxide (CO2) produced by volcanoes and various industrial processes has been described as a leading pollutant because of its role as a greenhouse gas. Combustion of coal and petroleum generates sulphur dioxide (SO2), further oxidation of SO2 in the presence of nitrogen dioxide (NO2) as a catalyst forms sulphuric acid (H2S04) and this acid rain which is associated with skin rashes and irritations, damage to monuments and buildings. Carbon monoxide (CO) forms smog in the air, a major cause of lung diseases and volatile organic compounds (VOCs) may lead to leukemia, prolong the life of methane (CH4) in the atmosphere and enhance global warming as efficient greenhouse gases because of their role in creating ozone (O3). Statistical data collected in twenty (20) big cities showed that daily within a metropolitan area is associated with concurrent daily fluctuations in ambient particulate matter (PM) concentrations (Samat et al, 2000).

The continued increase in air pollution is alarming. Sahara reporters (2016) reported that air pollutions is a major cause of diseases and death. The world health organization (WHO, 2014) reported that seven (7) million people died worldwide as a result of air pollution in 2012. Only a few studies which presented air quality data and compared each with standard limits have been carried out in Port Harcourt city of Rivers State, Nigeria (Akinfolarin et al, 2017).

Analyses of current air quality is an important tool for assessing a people's state of health and achievement of sustainable development goals in affected areas since air pollution indirectly affects the economy significantly by increasing medical expenditure and cost of preserving the surrounding (Pawan et al, 2009). Air quality forecasting is the tool that can help to deal with such objectives (Cecile et al, 2018). The world health organization calls on policy makers to promote the use of renewable energy and power sources and reduce industrial smoke stack emission in areas most affected by air pollution.

A good air quality shrinks health cost from air pollution related disease, expands worker productivity, increases life expectancy and reduces mortality. The objective of this study is to monitor and analyse the air quality of Obrikom/Omoku community, Rivers State, Nigeria.

II. Materials And Methods

Sampling Schedule and Study Area

The study was carried out in four (4) consecutive months (February, March, April and May, 2018) with respect to eight (8) air polluting gases, at Rivers State at Obrikom/Omoku, Rivers State, where industrial activities is high three (3) sites were established and sampled within the industrial area. Site one (SS1) was located by the hydrant water tank site two (SS2) was at the turbine hall, site three (SS3) was located at the switch yard and site four (SS4), non-industrial site (location) at Federal College of Education (Technical) Omoku as control.

A handheld global positioning system (GPS) was used to obtain the coordinates of the various sampling stations. In each of the stations the equipment was switched on and allowed to stabilize for five minutes after which readings (latitude longitude and point of elevation) were read off and recorded. The coordinates of the sampling sites are presented on table 1:

Table 1: Coordinates for Sampling Stations at Obrikom/Omoku "NAOC GAS" Plant.

	East (Longitude)	North (Latitude)
SS1	E6o39'45o570"	N5o23'250242"
SS2	E6o39'47o796"	N5o23'25o242"
SS3	E6o39'48o444"	N5o21'25o036"
SS4	E6o38'45o498"	N5o19'59o012"

In-situ Air quality Measurement

The quantity of the eight gases (Carbon Dioxide ($C0_2$), Nitrogen dioxide (NO_2), Methane (CH_4), carbon monoxide (CO), Sulphur dioxide (SO_2), Ammonia (NH_3), Volatile Organic Compound (VOC), Hydrogen sulphide (H_2S), available in the atmosphere were measured using aeroqual 500 series, a digital equipment with different sensors for each gas. At each site, sensors ere mounted to the aeroqual one after the other, each reading, read off and recorded when the equipment stabilizers and switched off thereafter, recorded gas sensor is removed and replaced with another until all eight sensors used and data for each gases recorded.

III. Results And Discussion

Carbon dioxide Levels

Table 1: Level of CO_2 in Omoku/Obrikom Industrial/Residential Areas

	SS1	SS2	SS3	Ctrl
January	654.00	678.87	684.33	648.53
February	659.67	681.72	699.34	643.40
March	653.42	666.25	745.29	649.94
April	653.09	661.55	718.96	652.36
Mean	655.04	672.10	711.98	648.56

Mean CO_2 ranged from 653.00 – 745.53 ppm in all sites. SS3 which is the turbine area had higher level of CO_2 due to combustion process (712) followed by SS2 (672.10) and SS1 (655.04). The control site had the lowest level (648.6ppm). two-way ANOVA indicate there was no significant difference in samples site across the months. Also no significant interaction between months and the CO_2 levels at he various sites ($p>0.05$).

Carbon Monoxide

	SS1	SS2	SS3	Ctrl
January	0.000	0.000	0.007	0.024
February	0.021	0.013	0.038	0.019
March	0.023	0.049	0.062	0.040
April	0.039	0.038	0.037	0.037

Carbon monoxide levels was insignificant and ranged from none to 0.04, with SS1 having highest (0.04ppm), followed by the control site. There was significant difference across the sample sites ($p<0.5$) but no significant across the months ($p>0.05$) (Table 2).

Methane

	SS1	SS2	SS3	Ctrl
January	13.00	339.67	20.02	13.15
February	13.15	349.40	13.50	12.11
March	12.87	300.30	12.97	13.20
April	13.16	332.07	12.43	11.67
Mean	13.04	330.36	14.73	12.53

Mean level of methane range from 12.53ppm at the control site to 330.36 at site 1. SS2 was exceptionally high. There was significant difference in mean methane level across the months as well as the sites ($p<0.05$)

Hydrogen sulphide

	SS1	SS2	SS3	Ctrl
January	0.00	0.01	0.00	0.01
February	0.01	0.08	0.05	0.04
March	0.12	0.12	0.13	0.13
April	0.01	0.03	0.03	0.02
Mean	0.04	0.06	0.05	0.05

Mean hydrogen sulphide was insignificant and ranged from 0.04 to 0.05, with the control site having higher level and SS1 the lowest.

Volatile Organic Acid

	SS1	SS2	SS3	Ctrl
January	0.00	0.00	0.16	0.01
February	0.10	0.11	0.11	0.10
March	0.12	0.13	0.13	0.12
April	0.14	0.15	0.15	0.15
Mean	0.09	0.10	0.10	0.014

VOC is lowest at SS3 and highest at SS3 where the turbine is located

Sulphur Dioxide

	SS1	SS2	SS3	Ctrl
January	0.00	0.00	0.00	0.02
February	0.01	0.00	0.01	0.01
March	0.02	0.00	0.00	0.00
April	0.01	0.02	0.01	0.02
Mean	0.01	0.01	0.01	0.01

Sulphur dioxide level ranged from 0.00 to 0.05ppm, with SS4 having higher levels.

IV. Discussion

Local air quality regulations often regulate specific emissions species as well as the secondary pollutants that these emissions may form. As a result, regulations may vary and be tailored to the local conditions and priorities in the countries where they are applied. An example of this is the difference in emphasis that they are applied. An example of this is the difference in emphasis that the European Union (EU) and the U.S. place on NO2, NOx, O3, with many EU states more concerned with NO2 concentrations and the U.S and others more concerned with NOX emissions, which is an O3 precursor.

Indicator of power generation contribution to air quality focuses on sulphur dioxide, particulate matter (PM), nitrogen dioxide and ground level ozone. The negative impacts of all four pollutants on human health are outlines in CS1 004 and power generation is the largest or among the largest sources of emissions related to these pollutants. Carbon monoxide emissions from gas flaring and combustion and hence the related concentrations have greatly reduced over the years and very few exceedances of the limit values are observed in European cities, so the indicator mentions but does not focus on this pollutant. Especially in oil and gas producing communities, where the majority of the workers and indigenous people lives and works, the contribution of power stations to the observed concentrations is especially high, leading to increased exposure levels to all four pollutants. It is therefore relevant to compare the concentrations observed at remote environment to those observed at background stations.

Humans can be adversely affected by exposure to air pollutants in ambient air.

V. Conclusion

Air quality measurement is essential to ensure that industries comply to stipulated standards in order to safeguard public health. Air quality measurements in and around power plant is within the regulated values with the exception of methane at site 2.

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