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Assessment Of The Abattoir Activities On Air Qualities Of Ogbor Hill, ABA And Environs

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***Abstract*—The study was done to assess the activities of abattoir operations on air qualities of Ogbor hill, Aba by measuring some air quality parameters in the wet season month of June 2016.Measurements were taken with Crowncon Gasman single gas monitors at various radial coordinates from three sampling stations and standard methods adopted for their sampling and analysis. Results showed that the mean concentrations of the gases SO_2 (6.477 ppm),CO(0.0196ppm), NO_2(1.493ppm), H_2S(2.722ppm) were higher than the permissible limit set by National Air Quality Standard(NAAQS) except particulate matter(49.1mg/m^3). This is an indication of contamination of the air quality as these parameters were contributing to pollution load of the environment. It is therefore recommended that the activities at the abattoir should be constantly monitored. Furthermore relocation of abattoir to an area far from residences, inspection of abattoir process by professionals in related fields, proper waste management systems should be made.**

Keywords—Abattoir,Ogbor-hill, sampling, analysis, parameters, pollution

INTRODUCTION

Air pollution can be referred to as the contamination of the air we breathe which occurs when the natural composition of the air is altered by natural and anthropogenic sources [1]. Air pollution damages our environment in many ways. Toxic pollutants and chemicals form acid rain and ground-level ozone that can damage trees, crops, wildlife, lakes and other bodies of water.[2] [3].In Ogbor hill abattoir, hygiene problems are not limited to slaughtering alone, the air is often polluted with thick smoke during the burning of animals (Plate1). The variable gases of the atmosphere can be altered by human activities, thereby having effects on the functions of the atmosphere which house the air we breathe. Abattoirs are a major source of air pollution worldwide [5]. Goats are roasted with kerosene and condemned tyres in the course of processing the meat for marketing leading to the emission of carbon monoxide into the atmosphere. The blood from the slaughtered animals is left flowing on the ground with offensive odour causing pollution in the atmospheric environment. This leads to pollution of such components such as soils, natural water resources and the entire environment, thus, rendering health problems to the people living around [6].

Abattoirs are generally known all over the world to pollute the environment either directly or indirectly from their various processes [7].[8]. In Nigeria, however, meat processing activities are mostly carried out in unsuitable buildings and by untrained personnel or butchers who are mostly unaware of sanitary principles [8].With inadequate slaughtering and disposal facilities, Ogbor hill abattoir has also become a source of pollution, attracting domestic and wild cannivores, rodents and flies which are vectors of diseases. The area is rampant with filth and scattered rubbish, which is left uncollected, apart from the blood draining trenches through which the filth is scattered rather than eliminated[9].Natural sources of air pollution include dust from barren ground surfaces and forest fires. Anthropogenic activities leading to air pollution include industrial processes, chemical emissions from plants, automobile, mowers, blowers and household cleaners [10]. Common air pollutants from numerous sources include; Particulate matter, Carbon monoxide, oxides of sulphur , oxides of nitrogen, photochemical oxidants and lead.

Plate 1;Atmospheric pollution during abattoir operations at Oghor Hill

Particulate Matter

Airborne particulates are a complex group of pollutants that vary in source, size and composition, depending on location and time such as soot sans smoke. The components include nitrates, sulphates, elemental carbon, organic carbon compounds, acid aerosols, trace metals and material from the earth's crust [11].Substances of biological origin, such as pollen and spores may also be present.

Carbon Monoxide

Carbon Monoxide(CO) is an odourless, colourless gas. It forms as a result of incomplete combustion of carbon in fuels. Different sources include vehicle and generator exhaust, industrial processes and natural sources such as wildfires. Carbon Monoxide has more affinity for haemoglobin in the presence of oxygen forming carboxyhaemoglobin.

Oxides of Sulphur

This is a colourless, reactive gas produced when sulphur containing fuels such as coal and oil are burned. Most of these come from industrial plants which emit sulphur as impurities.

Oxides of Nitrogen (NO_x)

This is a general term pertaining to compounds of nitric acid, nitrogen dioxide(NO_2) and other oxides of

nitrogen. Major sources of NO_x include power plants, large industrial facilities and automobiles. Nitrogen Oxides are typically created during combustion processes and are major contributors to smog formation and acid deposition.

Lead

This is another atmospheric pollutant but is predominant in urban areas.Lead comes from manufacturing sources, pesticides and from leaded gasoline,which when burnt in automobile is the major source of airborne lead in urban areas[12].

Photochemical Oxidants

Nitrogen Oxide combines with hydrogen to form a complex variety of secondary pollutants called photochemical oxidants. These oxidants together with solid and liquid particles in the air make up what is commonly known as smog.The photochemical oxidants include ozone, Nitrogen dioxide, aldehydes, acrolein and Peroxy-Acetyl Nitrates.

AIR QUALITY INDEX (AQI)

The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health .Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in many countries. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality.

An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level EPA has set to protect public health[13]. AQI values below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy-at first for certain sensitive groups of people, then for everyone as AQI values get higher.

The purpose of the AQI is to help us understand what local air quality means to our health. To make it easier to understand, the AQI is divided into six categories:

Air Quality Index (AQI) Values	**Levels of Health Concern**	**Colors**
***When the AQI is in this range*:**	***.air quality conditions are:***	***.as symbolized by this color:***
0 to 50	**Good**	**Green**
51 to 100	**Moderate**	**Yellow**
101 to 150	**Unhealthy for Sensitive Groups**	**Orange**
151 to 200	**Unhealthy**	**Red**
201 to 300	**Very Unhealthy**	**Purple**
301 to 500	**Hazardous**	**Maroon**

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the Hazardous category. Additional information on reducing exposure to extremely high levels of particle pollution is available here.

Each category corresponds to a different level of health concern. The six levels of health concern and what they mean are:

- "Good" AQI is 0 to 50. Air quality is considered satisfactory, and air pollution poses little or no risk.
- "Moderate" AQI is 51 to 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.
- "Unhealthy for Sensitive Groups" AQI is 101 to 150. Although general public is not likely to be affected at this AQI range, people with lung disease, older adults and children are at a greater risk from exposure to ozone, whereas persons with heart and lung disease, older adults and children are at greater risk from the presence of particles in the air.
- "Unhealthy" AQI is 151 to 200. Everyone may begin to experience some adverse health effects, and members of the sensitive groups may experience more serious effects.
- "Very Unhealthy" AQI is 201 to 300. This would trigger a health alert signifying that everyone may experience more serious health effects.

- "Hazardous" AQI greater than 300. This would trigger health warnings of emergency conditions. The entire population is more likely to be affected.

EPA has assigned a specific colour to each AQI category to make it easier for people to understand quickly whether air pollution is reaching unhealthy levels in their communities. For example, the colour orange means that conditions are "unhealthy for sensitive groups," while red means that conditions may be "unhealthy for everyone," and so on.The above descriptions are summarized below:

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	**0 to 50**	**Air quality is considered satisfactory, and air pollution poses little or no risk.**
Moderate	**51 to 100**	**Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.**
Unhealthy for Sensitive Groups	**101 to 150**	**Members of sensitive groups may experience health effects. The general public is not likely to be affected.**
Unhealthy	**151 to 200**	**Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.**
Very Unhealthy	**201 to 300**	**Health alert: everyone may experience more serious health effects.**
Hazardous	**301 to 500**	**Health warnings of emergency conditions. The entire population is more likely to be affected.**

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the "Hazardous category." Additional information on reducing exposure to extremely high levels of particle pollution is available here.

MATERIALS AND METHODS

Study area

Ogbor hill, abattoir is situated in the commercial nerve center of Aba in Aba North Local Government Area of Abia state(Fig.1) . Aba is located in South Eastern region of Nigeria ,between latitude 5.05^{o}N 7.22^{o}SE and longitude 5.30^{o}N 7.15^{o}E.The town is a major economic hub in commercial enterprises such as pharmaceuticals, abattoir operations, manufacturing, plastics among others, which generate enormous waste. The components of these wastes include metals, organic materials, papers, plastics, among others. The residents are mainly traders, artisans, including professionals in different fields and civil servants. The climate involves two distinct seasons, dry and wet season with the former starting from November to February while wet season ranges from March to October though variations may occur[14].However a period characterised by dusty winds, cold and dry conditions known as harmattan normally starts from December and February.

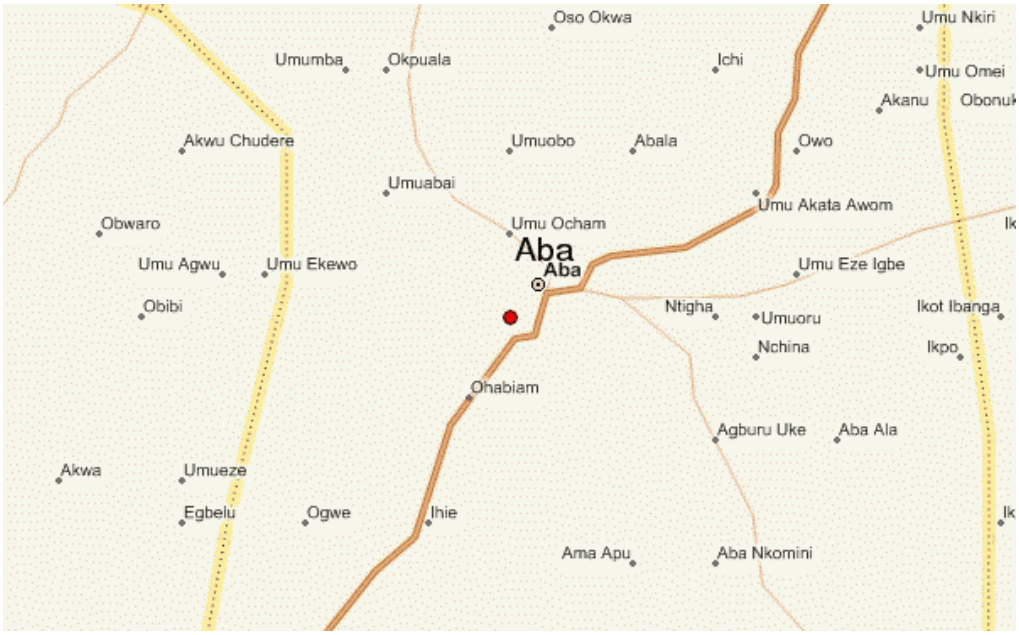


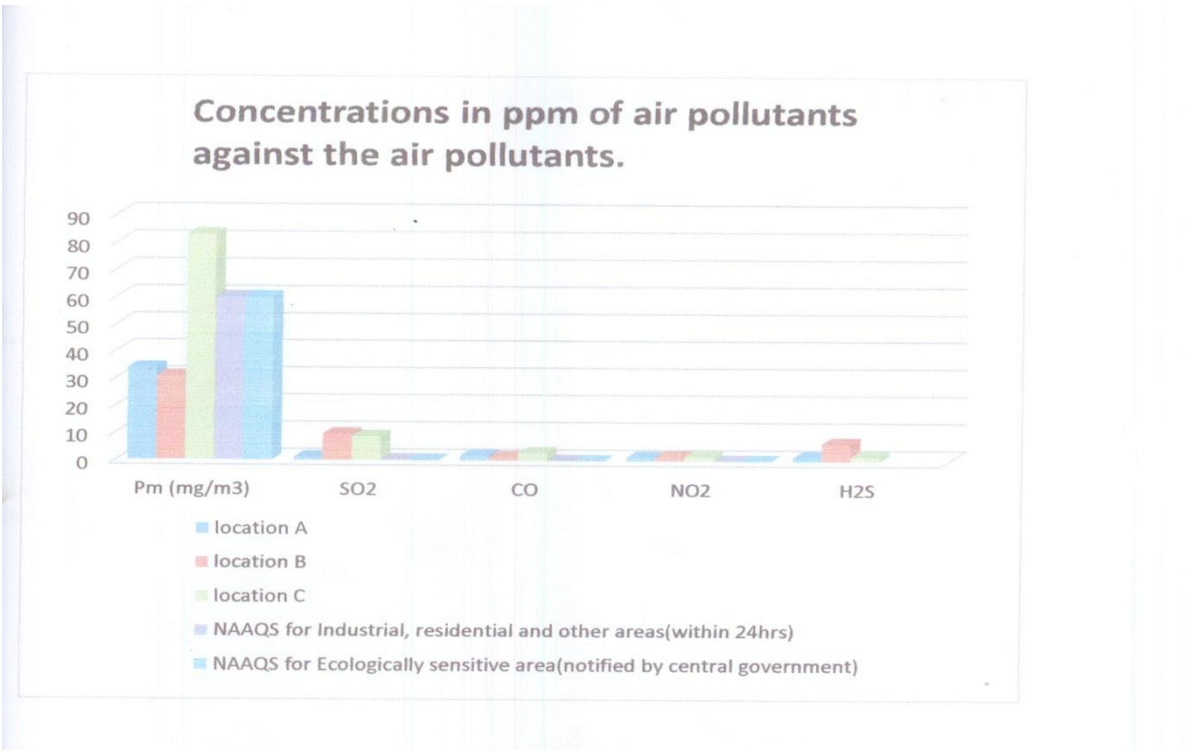
Fig 1: Map of Aba North Local Government Area,Showing study area.

Sampling and field studies

Three sampling stations upstream, discharge point and downstream were selected for comparative analysis. The discharge station was the point the burning of animals took place, while the downstream was the point 100m away from the point of burning. The upstream was the distance before the burning point. The coordinates was taken at each of the stations with Global Positioning System (GPS). At each of the locations, the gasman *crowcon* gas monitoring equipment and particulate matter sampler were each used respectively by placing at a height of 4-5ft for air quality sampling and analysis. The gasman *crowcon* gas monitoring equipment and particulate matter sampler displayed readings of the concentrations of the different gases sampled, which were calibrated to zero before taking the readings. The samples were collected along the direction of the wind from six replicate points, two from each coordinates from morning when the animals were to be burned with the tyres till evening as the workers were closing. The concentrations of SOx, NOx ,CO, H_2S were given in parts per million (ppm), while particulate matter was measured in mg/m^3.The readings were displayed on the screen of the instruments after three minutes when the green light becomes steady. The statistical analysis employed was the descriptive statistics such as mean, standard deviation and coefficient of variation. The data was subjected to Student t-test for the comparison of the mean differences between the survey values and theFEPA limit.The statistical descriptions for concentrations of the air quality parameters are shown in fig.2.

Table 1: Air Pollutant Emissions and Concentrations of Ogbor hill

Pollutants	Sampling Locations		
	A Upstream ($N05^0 7.431^1$) ($E007^0 22.888^1$)	B Discharge point ($N05^0$ 45.027^1) ($E007^0$ 29.276^1)	C Downstream $N05^0$ 06.968^1) ($E007^0$ 22.816^1)
Particulate matter (PM)mg/m^3	33.7	30.08	82.9
Sulphur dioxide (SO_2)ppm	1.07	9.62	8.74
Carbon monoxide (CO) ppm	1.80	1.26	2.82
Nitrogen dioxide (NO_2)ppm	1.34	1.57	1.57
Hydrogen sulphide (H_2S)	1.6	6.48	1.67



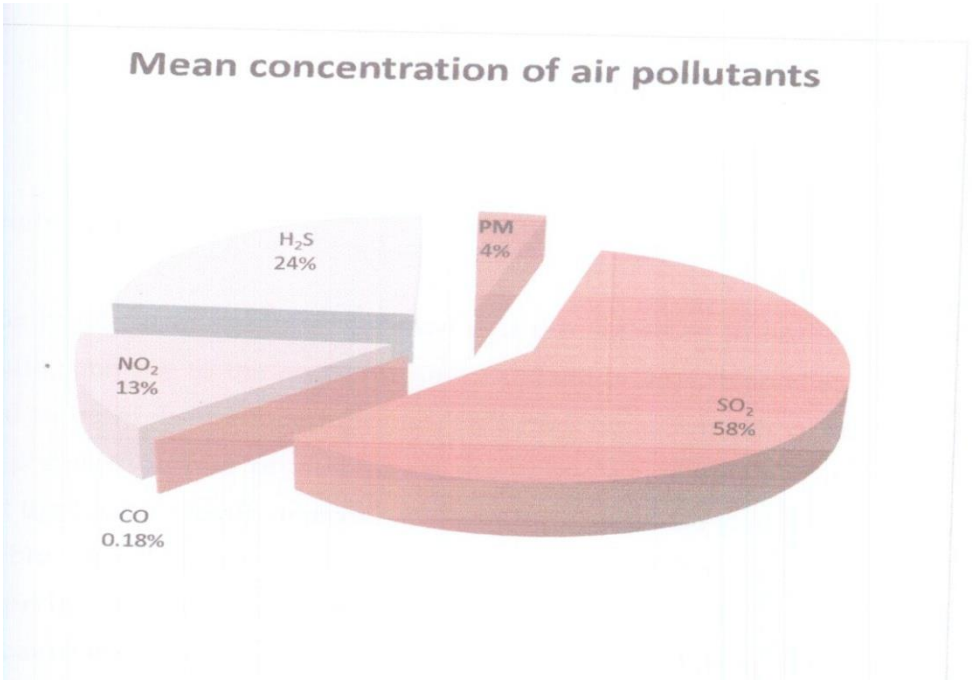


Fig.2:Statistical description of the concentrations of air parameters

Table 2: Comparison of air quality result with recommended permissible limit of the NAA QS; (NAAQS,2009)

Sampling LocationsNational Ambient Air Quality Standards					
Parameters	A Upstream ($N05^0 7.431^1$) ($E007^0 22.888^1$)	B Discharge point ($N05^0$ 45.027^1) ($E007^0$ 29.276^1)	C Downstream $N05^0$ 06.968^1) ($E007^0$ 22.816^1)	Industrial, Residential and other areas (within 24hrs)	Ecologically sensitive area (notified by Central Government
Particulate matter (PM)mg/m^3	33.7	30.08	82.9	60	60
Sulphur dioxide (SO_2)ppm	1.07	9.62	8.74	0.31	0.31
Carbon monoxide (CO) ppm	1.80	1.26	2.82	0.0035	0.0035
Nitrogen dioxide (NO_2)ppm	1.34	1.57	1.57	0.041	0.041
Hydrogen sulphide (H_2S)	1.6	6.48	1.67	-	-

Table 3: The mean and standard deviation of the air quality sampling results of Ogbor Hill

Sampling Locations					
Parameters	A Upstream ($N05^0 7.431^1$) ($E007^0 22.888^1$)	B Discharge point ($N05^0$ 45.027^1) ($E007^0$ 29.276^1)	C Downstream $N05^0$ 06.968^1) ($E007^0$ 22.816^1)	Mean	Standard deviation
Particulate matter (PM)mg/m^3	33.7	30.08	82.9	49.1	23.9
Sulphur dioxide (SO_2)ppm	1.07	9.62	8.74	6.477	3.839
Carbon monoxide (CO) ppm	1.80	1.26	2.82	0.0196	0.0065
Nitrogen dioxide (NO_2)ppm	1.34	1.57	1.57	1.493	0.108
Hydrogen sulphide (H_2S)	1.6	6.48	1.67	2.722	2.742

DISCUSSION

The concentrations of particulate matter showed the highest level of 82.9mg/m^3 at station C(downstream) and the lowest at station B(30.8mg/m^3).The concentration level at C exceeds the National Ambient Quality Standard(NAAQS) limit(60mg/m^3) set by the central pollution control board for industrial, residential, rural areas within 24 hours, as well as the permissible level for sensitive areas within 24hours.The lowest value at the point of burning of the animals(discharge point),and the highest at some meters away(downstream) seems to obey the law of diffusion of gases, which states that 'gases move from areas of higher concentration to those of lower concentration'. The particulate matters emanating from the roasting of skins of animals with tyres clog and travel from this point to other areas[15]. The levels of oxides of Nitrogen at the sampled locations shows that the maximum value of 1.57ppm was obtained at stations B and C, with the lowest value of 1.34ppm at the control station. These values exceeded the prescribed standard of NAAQS for residential rural, ecological sensitive areas and other areas which is 0.041ppm. Combustion processes from motor vehicles within the vicinity of the abattoir and protein from food waste may be major sources of oxides of nitrogen[16].The levels of Sulphur oxides at the three locations A,B,C(1.07ppm, 9.62ppm,8.74ppm) exceeded both the NAAQS permissible limit of 0.31ppm for industrial, rural and residential areas within 24 hours period and ecologically sensitive area of the same period. The concentration at the downstream is slightly lower than the discharge point showing the circulation of the atmospheric air mass is influenced by other factors such as temperature, wind pattern and speed[17].The high level of Sulphur Oxides at the study area may be due to tyre and kerosene used for burning the animals for slaughtering. The concentrations of Carbon Monoxide CO in the stations were within the prescribed limit of 0.0035ppm by NAAQS for residential, rural and industrial areas.CO emanate from combustion processes from fossil fuels and from the decomposition of organic wastes in municipal solid wastes and the raising of livestock[18]. The levels of Hydrogen sulphide showed that the highest concentration of 6.48ppm was obtained at the discharge point and the lowest at the control point.

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