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EVALUATION OF THE ON-SITE AND OFF-SITE AMBIENT AIR QUALITY (AAQ) AT NEKEDE WASTE DUMPSITE, IMO STATE, NIGERIA

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ABSTRACT: *The study focused on the evaluation of the on-site and off-site ambient air quality at Nekede dumpsite. It sought to find out the concentration of Methane (CH_4), Carbon (NH_3), Nitrogen (IV), Oxide (NO_2), Particulate Matter (PM_{10}) and Sulphur (IV) Oxide (SO_2) from the waste dumpsite to a distance of 300 meters. Samples were collected on four sampling points, one hundred meters apart between the month of March and May, 2013. The data was collected in two sessions (morning and evening) using the Crowcon Portable Gas Analyzer. Result show that with the exception of CO, other air pollutants (CH_4, H_2S, NH_3, NO_2, PM_{10} and SO_2) observed exceeded the concentration values stipulated by FMENV, WHO and USEPA., resulting to serious health implications that called for environmental redress for better tomorrow in the area of solid waste management.*

KEYWORDS: Onsite and offsite**,** Ambient Air, Criteria Pollutants, Dumpsite

INTRODUCTION

The occurrence of air pollution in any giving environment is a function of both natural and anthropogenic factors. However, anthropogenic factors are presently considered as the largest sources of indoor and outdoor air pollution. Air pollution is spatial-temporal. Thus, Ubuoh and *Akhionbare (2011),* Agwu and Ozeh (2013) posit that the quality of ambient air is determined by the extent of pollution in that environment.

Air pollution is the introduction of particulates, biological molecules and other harmful substances into the atmosphere which could be either solid or gaseous. The pollutants introduced into the atmosphere through air pollution can have severe effect on humans and the ecosystem in general. According to USEPA (2012), criteria pollutants are commonly found air pollutants which could have severe health and environmental implications. These pollutants include; Particulate Matter (PM_{10}), Carbon monoxide (CO), Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Methane (CH_4), Ammonia (NH_3), Hydrogen sulphide (H_2S) and so on. Some of these air pollutants such as hydrogen sulphide, ammonia and carbon monoxide are colourless and invisible (Hassan and Abdullahi, 2012). However, particulate matter could be visible and include dust and soot. Though criteria pollutants are naturally present in air, Dare (2000) opines that anthropogenic activities such as bush-burning, industrial processes and decaying of accumulated organism and domestic wastes among others increase their concentration in the air.

Scientists have found a link between the level of pollution in an environment, the mortality rate and life expectancy for that area (Akinremi, 2006). The World Health Organization (WHO) reported in 2005 that more than two million premature deaths that occur each year can be attributed to the effects of indoor and outdoor air pollution. This air pollution is a significant risk factor for a number of health conditions. Specifically, sulphure dioxide and nitrogen

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dioxide have been reported to cause respiratory and cardiovascular diseases in children and adult (AHA, 2010 and WHO, 2011). Agwu and Ozeh (2013) hold that the inhalation of particulate matter can cause adverse health effects such as asthma, bronchitis, lung cancer, cardiovascular disease, birth defect and premature death.

The ambient air pollution is a major environmental health problem for both developed and developing countries. The World Health Organization estimates that about 80% of the outdoor air pollution-related premature deaths were due to ischemic heart disease and stroke.14% of the deaths were due to chronic obtrusive pulmonary disease or acute lower respiratory infections 6% of the deaths were due to lung cancer.

In Nigeria as in most developing countries of the world waste dumpsite often contain a mixture of general waste, toxic, infections and radioactive waste. These wastes are susceptible to burning (Uwakwe, 2012). The Nekede open dumpsite near Owerri, Imo State is not an exception as all manner of solid wastes (toxic and non- toxic, degradable and non-degradable) are deposited in the dumpsite. Though the Nekede dumpsite is a legal dumpsite, the waste in the dumpsite are burnt indiscriminately. The burning sometimes lasts for days. This culminates in the emission of enormous quality of pollutants into the atmosphere of the immediate and surrounding environment of the dumpsite.

It is against this background that the researchers seek to find out the on-site and off-site ambient air quality of the Nekede dumpsite.

MATERIAL AND METHODS

The study was carried out at Nekede waste dumpsite in Owerri Metropolis at a graded distance of one hundred meters apart over a distance of three hundred meters. The data on the concentration of the ambient air pollutants was collected in two sessions (morning and evening) twice a week and for a period of three months (March-May, 2013). Each session lasted for an hour. The Crowcon Gasman Air Analyzer, model CE-89/336/EEC was used in-situ to establish the concentration of the different parameters. Inference on the overall concentration of the ambient air pollutant was drawn using mean, standard deviation and range.

RESULTS AND DISCUSSION

Results of the ambient air quality within the study area are presented in Table 1- 3 below**:**

Table 1: Mean, Standard Deviation and Range of on-site ambient air pollutants' concentration at the Nekede dumpsite in the morning and evening.

Session	CH_4	CO	H_2S	NH_3	NO_2	PM_{10}	SO_2
Morning	013±0.01	0.30±0.02	0.82±0.02	0.08±0.02	0.09±0.02	6.57±0.25	0.11±0.02
	0.12-0.14	0.28-0.31	0.80-0.84	0.06-0.10	0.08-0.11	6.30-6.80	0.09-0.13
Evening	0.10±0.02	0.22±0.02	0.80±0.02	0.07±0.02	0.08±0.02	6.17±0.21	0.08±0.02
	0.09-0.12	0.20-0.24	0.79-0.82	0.05-0.09	0.07-0.10	6.00-6.40	0.06-0.10

Source: Author's Work, 2013. Parameter values in ppm.

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Table 2: Mean, standard deviation and range of ambient air pollutants' concentration at 100 meters from the Nekede dumpsite in the morning and evening.

Session	CH_4	CO	H_2S	NH_3	NO_2	PM_{10}	SO_2
Morning	0.11±0.02 0.10-0.13	0.47±0.04 0.43-0.50	0.62±0.03 0.60-0.65	0.08±0.02 0.06-0.09	0.07±0.01 0.07-0.08	6.43±0.25 6.20-6.70	0.08±0.02 0.07-0.10
Evening	0.06±0.02 0.05-0.08	0.29±0.03 0.27-0.32	0.71±0.20 0.50-0.90	0.05±0.02 0.04-0.07	0.05±0.01 0.04-0.06	5.90±0.20 5.70-6.10	0.08-0.02 0.06-0.09

Source: Author's Work, 2013. Parameter values in ppm.

Table 3: Mean, standard deviation and range of ambient air pollutants' concentration at 200 meters distance from the Nekede dumpsite in the morning and evening.

Session	CH_4	CO	H_2S	NH_3	NO_2	PM_{10}	SO_2
Morning	0.07±0.02 0.06-0.09	0.52±0.04 0.49-0.56	0.56±0.03 0.54-0.59	0.08±0.02 0.06-0.10	0.07±0.01 0.06-0.08	5.50±0.20 5.30-5.70	0.07±0.02 0.05-0.08
Evening	0.06±0.02 0.05-0.08	0.32±0.02 0.30-0.34	0.64±0.17 0.47-0.80	0.06±0.03 0.04-0.09	0.06±0.02 0.05-0.08	5.80±0.21 5.60-6.01	0.04±0.02 0.03-0.06

Source: Author's Work, 2013. Parameter values in ppm.

Table 4: Mean, standard deviation and range of ambient air pollutants' concentration a 300 meters distance from the Nekede dumpsite in the morning and evening.

Session	CH_4	CO	H_2S	NH_3	NO_2	PM_{10}	SO_2
Morning	0.04±0.01 0.03-0.05	0.66±0.30 0.63-0.69	0.35±0.04 0.31-0.39	0.02±0.02 0.01-0.04	0.03±0.01 0.03-0.04	3.20±0.20 3.00-3.40	0.04±0.02 0.02-0.05
Evening	0.05±0.02 0.03-0.07	0.42±0.02 0.40-0.44	0.35±0.06 0.29-0.40	0.02±0.01 0.01-0.03	0.04±0.01 0.03-0.04	3.00±0.10 2.90-3.10	0.05±0.02 0.04-0.07

Source: Author's Work, 2013. Parameter values in ppm.

DISCUSSION

The findings in Table1 indicate that the mean of concentration of CH_4, CO, H_2S, NH_3, PM_{10}, SO_2, at the dumpsite were higher in the morning compared to the evening hours. In Table 2, the result shown that at a distance of one hundred meters from the dumpsite, CH_4, CO, NH_3, NO_2, PM_{10}, and SO_2 pollutants had a higher concentration in the morning hours while CH_4, NO_2 and SO_2 had higher concentrations in the evening hours.

From Table 1-4, the trend in the concentration of the air pollutants indicate that apart from CO, other air pollutants (CH_4, H_2S, NH_3, NO_2, PM_{10} and SO_2) observed had a decreased concentration from the dumpsite. This is true both for the morning and evening hours. This decrease in concentration may be attributed to the effect of distance and temperature variations on pollutants' concentration away from their source of region.

However, the increase of CO concentration away from the dumpsite could be due to the effect of vehicular emissions as vehicular movements are heavily concentrated about seven hundred meters away from the Nekede dumpsite. Despite the increase in carbon monoxide

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concentration away from the dumpsite, the recorded values of carbon monoxide concentrations fall within the threshold values of carbon monoxide as recommended by FMENV (1991), WHO (2011) and USEPA (2012). Beside carbon monoxide, the concentrations of methane, hydrogen sulphide, ammonia, nitrogen dioxide, particulate matter and sulphur dioxide were found to be higher than recommended standard of all the recognized statutory bodies. The findings of this study is consistent with that of Ugwu and Ofomatah (2011), Hassan and Abdullahi (2012) and Agwu and Azeh (2013).

According to information collected by the Connecticut Department of Health, the concentration of hydrogen sulfide in ambient air around a landfill is usually close to 15 ppb People around this environment could suffered from asthma (ATSDR, 1999b).

The main effect of breathing in raised levels of nitrogen dioxide is the increased likelihood of respiratory problems (ATSDR,1999a; CTDPH ,1999).. Nitrogen dioxide inflames the lining of the lungs, and it can reduce immunity to lung infections. This can cause problems such as wheezing, coughing, colds, flu and bronchitis. Increased levels of nitrogen dioxide can have significant impacts on people with asthma because it can cause more frequent and more intense attacks. Children with asthma and older people with heart disease are most at risk (Kurtenbach et al. 2012). The effects of ammonia on children are likely to be the same as for adults. Ammonia is an irritant and the solution and gas can cause burns of the skin, eyes, mouth, and lungs. If a spill occurs, children may be exposed to ammonia for a longer time than adults because they may not leave the area as quickly (Department of the Environment and Heritage, 2005). There is a strong and consistent body of evidence indicating that exposure to fine particulate matter (PM) increases the risk of respiratory and cardiovascular disease, cancer, and mortality (*Krewski et al. 2005; Samet and Krewski 2007; Tsai et al. 2012; Yang 2008;* WHO, 2012). Exposure to sulfur dioxide occurs from breathing it in the air. It affects the lungs and at high levels may result in burning of the nose and throat, breathing difficulties, and severe airway obstructions (ATSDR, 1998). These then call for pre-cautions for sustainable ambient air quality around landfill for environmental sustainability.

CONCLUSION

From the result, it is concluded that with the exception of co, other pollutant (CH_4, H_2S, NH_3, NO_2, PM_{10} and SO_2) had a decreased concentration from the dumpsite. Also these pollutants apart from co, had a higher concentration than the recommended standards by the federal ministry of environment, World Health Organization and the united states Environmental protection Agency Based on the findings, the following recommendations are made.

a. Proper waste disposal and best waste management practice should be implemented at the Nekede dumpsite. The implementation should be monitored by Government from Health officers (GHOS) and Environmental Experts from non- government organization to ensure total compliance.

b. Due to the health implication of the observed high concentration of ambient air pollutant within and around Nekede Dumpsite, it is suggested that an extensive awareness campaigns be carried out as a measure of public health protection.

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