

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 (CH₄), Carbon (NH₃), Nitrogen (IV), Oxide (NO₂), Particulate Matter (PM₁₀) and Sulphur (IV) Oxide (SO₂) 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, 2014. 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 (CH₄, H₂S, NH₃, NO₂, PM₁₀ and SO₂) observed exceeded the concentration values stipulated by FMENV, WHO and USEPA.*

KEYWORDS: Onsite, Offsite, Ambient Air, Criteria Pollutants, Dumpsite

INTRODUCTION

The occurrence of air pollution in any given 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 (PM₁₀), Carbon monoxide (CO), Nitrogen dioxide (NO₂), Sulphur dioxide (SO₂), Methane (CH₄), Ammonia (NH₃), Hydrogen sulphide (H₂S) 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 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 radio active 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

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 ₂ S	NH ₃	NO ₂	PM ₁₀	SO ₂
Morning	013±0.01 0.12-0.14	0.30±0.02 0.28-0.31	0.82±0.02 0.80-0.84	0.08±0.02 0.06-0.10	0.09±0.02 0.08-0.11	6.57±0.25 6.30-6.80	0.11±0.02 0.09-0.13
Evening	0.10±0.02 0.09-0.12	0.22±0.02 0.20-0.24	0.80±0.02 0.79-0.82	0.07±0.02 0.05-0.09	0.08±0.02 0.07-0.10	6.17±0.21 6.00-6.40	0.08±0.02 0.06-0.10

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

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 ₂ S	NH ₃	NO ₂	PM ₁₀	SO ₂
Morning	0.11±0.02	0.47±0.04	0.62±0.03	0.08±0.02	0.07±0.01	6.43±0.25	0.08±0.02
	0.10-0.13	0.43-0.50	0.60-0.65	0.06-0.09	0.07-0.08	6.20-6.70	0.07-0.10
Evening	0.06±0.02	0.29±0.03	0.71±0.20	0.05±0.02	0.05±0.01	5.90±0.20	0.08-0.02
	0.05-0.08	0.27-0.32	0.50-0.90	0.04-0.07	0.04-0.06	5.70-6.10	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 ₂ S	NH ₃	NO ₂	PM ₁₀	SO ₂
Morning	0.07±0.02	0.52±0.04	0.56±0.03	0.08±0.02	0.07±0.01	5.50±0.20	0.07±0.02
	0.06-0.09	0.49-0.56	0.54-0.59	0.06-0.10	0.06-0.08	5.30-5.70	0.05-0.08
Evening	0.06±0.02	0.32±0.02	0.64±0.17	0.06±0.03	0.06±0.02	5.80±0.21	0.04±0.02
	0.05-0.08	0.30-0.34	0.47-0.80	0.04-0.09	0.05-0.08	5.60-6.01	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 at 300 meters distance from the Nekede dumpsite in the morning and evening.

Session	CH ₄	CO	H ₂ S	NH ₃	NO ₂	PM ₁₀	SO ₂
Morning	0.04±0.01	0.66±0.30	0.35±0.04	0.02±0.02	0.03±0.01	3.20±0.20	0.04±0.02
	0.03-0.05	0.63-0.69	0.31-0.39	0.01-0.04	0.03-0.04	3.00-3.40	0.02-0.05
Evening	0.05±0.02	0.42±0.02	0.35±0.06	0.02±0.01	0.04±0.01	3.00±0.10	0.05±0.02
	0.03-0.07	0.40-0.44	0.29-0.40	0.01-0.03	0.03-0.04	2.90-3.10	0.04-0.07

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

DISCUSSION

The findings in Table 1 indicate that the mean of concentration of CH₄, CO, H₂S, NH₃, PM₁₀, SO₂, 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, CH₄, CO, NH₃, NO₂, PM₁₀, and SO₂ pollutants had a higher concentration in the morning hours while CH₄, NO₂ and SO₂ 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 (CH₄, H₂S, NH₃, NO₂, PM₁₀ and SO₂) 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 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 standards 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).

CONCLUSION

From the result, it is concluded that with the exception of CO, other pollutant (CH₄, H₂S, NH₃, NO₂, PM₁₀ and SO₂) 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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