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Investigating the Effect of Gas Flaring on the Physicochemical Properties of Air and Rainwater in Oil-Producing Region of Orashi- ONELGA

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Abstract

Purpose: The effect of Gas flaring on the physical properties of air and rainwater in oil producing region of Orashi and Ogba/Egbema/Ndoni local government area (ONELGA) in particular was investigated. Specifically, the study determined the air quality of Omoku, Obite, Obrikom and Ebocha, heavy metal (Cd, Cr, Cu, Fe, Pb, Zn) levels and physicochemical parameters of rainwater and compare the values with WHO standard limit of air and rainwater as well as establish a base line data on the possible consequences of gas flaring on these communities.

Methodology: Indices of air quality parameters like H_2S, NO_2, SO_2, CO, and VOCs were measured using Aeroqual air quality meter. Standard Methods for the examination of water and wastewater was employed to determine the pH, Conductivity/TDS, Total Dissolved Solids and Turbidity.

Findings: The results obtained show that the quality of air within the three communities when compared with the control is still able to support lives (both humans/animals and plants). The heavy metals level of rainwater was below detection level.

Unique Contribution to Theory, Practice and Policy: The values obtained are variable among the communities and within the range that could support lives. The amount of particulate matter in the atmosphere has not gotten to the state of serious threat to stopping lives from existing within the areas. The accumulation of these particles is still manageable for now in the area. The study shows traces of acid rain which is not higher than the recommended value of the dissolved particles. Hence, less visible corrosion of metals and roofing sheets in the Local Government Area.

Keywords: *Gas Flaring, Air Quality, Rainwater Quality, Baseline*

INTRODUCTION

Air pollution today is a global problem which has attracted researchers' attention. It is simply defined as the presence of certain substances in the air in high enough concentrations and for long enough duration to cause undesirable effects. The protection of the Environment is the main issue confronting oil and gas industry today. This is because of its associated air pollutants that are hazardous to the biophysical environment with a negative effect on human health and the environmentt (Feigin et al., 2016; Idah & Izah, 2017).

The Niger Delta in Nigeria being the hub of oil exploration and production is known to be one of the main gas flaring zones in the world today (Elijah, 2022, Ukhurebor et al, 2024). Nigeria's gas flaring contributes greatly to the global warming problems in the world. The flares from Oil and Gas facilities which results in air pollution, adversely affect human health, agriculture crops, animals and ecosystems of the host communities.

Nigeria is ranked the 13th main producer of crude oil in the world (Elwerfelli & Benhin, 2018; Nwaogu & Onyeze, 2020). Following the discovery of crude oil in late 1950's, Nigeria shifted from the agrarian nation to a crude oil dependent nation. As such, income resulting from crude oil sales is used in financing a significant number of the nation's annual budgets. The crude oil and natural gas province of Nigeria is found in the Niger Delta (including Ondo, Edo, Delta, Bayelsa, Rivers, Abia, Imo, Akwa Ibom and Cross River States), where they are found in both offshore (aquatic ecosystem) and onshore (land environment). During crude oil and natural gas production, there are adverse environmental and health related consequences. For instance, crude oil spill in the environment could lead to an alteration in the physicochemical characteristics of receiving soil, water resources and ambient air quality. Cases of spills leading to fire which impacted on infrastructures and biodiversity have been reported (Okeke et al, 2023; Ubiji et al, 2025).

Nigeria produces over 2.3 million barrels of oil per day from its oil fields in the Niger Delta alone and most of this oil comes from deposits containing associated natural gas. About 2 billion standard cubic feet of this associated gas is produced every day and sadly enough, most of it is flared due to inadequacy in facilities for its utilization (Felgin et al, 2016; Vanguard News, 2019). Worse still, successive governments and regulators have since ignored the environmental impact of gas flaring, but rather continued prolonging flaring phase-out dates since 2008. With increasing production of crude oil since its discovery in Oloibiri, Bayelsa State in 1956, gas flaring activities have also been on the increase (Ukhurebor et al, 2024; Nwaogu & Onyeze, 2020).

Gas flaring is common in the Niger Delta, as such, Atuma & Ojeh (2013) estimated that 35 million tons and 12 million tons of carbon dioxide and methane, respectively are released into the Nigerian environment from flared gas. In summary, about 11- 42.54% of total natural gas produced are flared into the environment making Nigeria one of the highest gas flaring nations on global perspective (Olukoya, 2008). During gas flaring, nitrogen dioxides, sulphur dioxide, volatile organic compounds, (VOCs) like benzene, toluene, xylene, polycyclic aromatic hydrocarbons (PAHs), hydrogen sulphide, benzapyrene and dioxins, particulate and methane gas are released into the environment. The composition and quantity depend on the physical and chemical characteristics of the gas being flared. Atuma & Ojeh (2013) reported that carbon dioxide, methane, nitrous oxide, water vapour and sulphur dioxide are the main constituents of flared gas. In Nigeria, vertical and horizontal flare stakes are used and gas flaring could impact on infrastructures including roofing sheet, buildings/structures, artifacts, monuments and paints (Okoro et al, 2021; Nwaogu, & Onyeze, 2020).

The continuity of life on earth hinges on the availability of water. Water, though relatively distributed worldwide, suffers portability owing to anthropogenic and other biogenic activities. In short, Water remains one of the environmental resources that suffers exploitation by life activities. In a general point of view, water related challenges are either as a result of too much water with poor portability or scarcity of water (Nwaogu & Onyeze, 2020)

Environmental contamination of air, water, soil, food and properties has become a threat to the continued existence of many plants and animal communities and ultimately threatens the very survival of the human race (Ubani. & Onyejekwe, 2013; Idah & Izah, 2017). It is now very obvious, even to those who had initial doubts about the veracity of the claim by scientists, that flaring of gas has a negative effect on the environment. The negative effects of gas flaring on the environment includes, acid rain formation, greenhouse effect, global warming and ozone depletion. Even the rural dwellers know and believe that the flaring of gas is damaging their health, reducing crop production, destroying the rivers and streams and damaging their homes.

Petroleum exploitation and production in the Niger Delta over the years have resulted in a number of environmental, socio-economic and political problems in the region. Among these are oil spillage and gas flaring that have caused severe environmental damages, loss of plants, animals and human lives and loss of revenue to both the oil producing companies and the government. Petroleum exploration, exploitation, production, storage, distribution and transportation activities affect the environment in a conspicuously negative manner. Vegetation is removed to make way for seismic lines and sites. Storage, distribution and transportation of oil and gas impacts negatively on the environment and socio-economic wellbeing of the people (Ani et al, 2017; Okoro et al, 2021). Gas flaring is the burning of natural gas that is associated with crude oil during oil exploration (Ajugwo, 2013; Ukhurebor et al, 2024). Flaring is employed to dispose of this associated gas in petroleum-producing areas where insufficient investment was made in infrastructure to utilize natural gas. Nigeria is among world's biggest flarer of gas and released over several billion/m^3 of gas per annum (Vanguard News 2019; World Bank 2020; Elehinafe et al, 2022). Due to poor infrastructure and unsustainable practices among oil companies, only 19% of the total gas flared is recovered.

In order to address the problems of gas flaring, it is necessary to understand why the natural gas is being flared. This is because oil and natural gas are mixed in every oil deposit. The natural gas called "associated gas" (AG) must be removed from oil before refining. Gas flaring is simply the burning of this associated gas. Gas flaring is currently illegal in most countries of the world, where gas flaring might only occur in certain circumstances like emergency shutdowns, non-planned maintenance *or* disruption to the processing system (Ajugwo, 2013).

The flares associated with gas flaring give rise to atmospheric contaminants. These include oxides of Nitrogen, Carbon and Sulphur (NO_2, CO_2, CO, SO_2), particulate matter, hydrocarbons and ash, photochemical oxidants and hydrogen sulphide (H_2S). These contaminants acidify the soil, depleting soil nutrient. Hence, the nutritional values of crops within such vicinity are reduced. In some cases, there is no vegetation in the areas surrounding the flare due, partly, to the tremendous heat that is produced and acid nature of soil pH (Ubani & Onyejekwe, 2013; Aregbe, 2017; Idah, 2017; Johnson et al, 2022).

Gas flaring precipitates global climate change and greenhouse effect resulting in gradual rise in atmospheric temperature and depletion of the ozone layer (the natural cooling shield from sun ray's insulation and heat in the sky) (Raimi *et al*., 2013). These expose the earth to high intensity of solar radiation; the effect of this environmental threat includes food insecurity, increasing risk of disease, acid rain, rain corrosion of buildings and the rising costs of extreme weather damage because of the presence of widely recognized toxins like benzene in the air (Elehinafe et al, 2022 Ekpoh & Obia, 2010 Recent report indicated that gas flaring represents an annual economic loss to the country of about US $2.5 billion.

The effects of the changes in temperature on crops included stunted growth, scotched plants and such other effects as withered young crops (Orimoogunje *et al*., 2010; Uyigue & Enujekwu, 2017). Furthermore, he concluded that the soils of the study area are fast losing their fertility and capacity for sustainable agriculture due to the acidification of the soils by the various pollutants associated with gas flaring in the area.

Acid rains have been linked to the activities of gas flaring (Elijah, 2022; Elehinafe 2022; Ubiji et al, 2025). Corrugated roofs in the Delta region have been corroded by the composition of the rain that falls as a result of flaring. The primary causes of acid rain are emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO) which combine with atmospheric moisture to form sulfuric acid and nitric acid, respectively. Size and environmental philosophy in the industry have very strong positive impact on the gas-flaring-related CO_2 emission (Hassan & Konhy, 2013).

Gas flaring results in acid rain within the flared microenvironment. The effect of gas flaring on rainwater resources has been extensively investigated in the Western Niger-Delta region (Enetimi & Sylvewster, 2017; Idah, 2017; Elehinafe et al, 2022; Elijah, 2022) but the degree and geographical extent of gas flaring effect on rainwater in the eastern parts of the Niger-Delta region has remained relatively scanty. This study therefore was undertaken to determine the air quality of three ONELGA communities where gas flaring occurs- Obite, Obrikom and Ebocha, as well as the heavy metal (Cd, Cr, Cu, Fe, Pb, Zn) levels and physicochemical parameters of their rainwater and compare the values with WHO standard limit of air and rainwater as well as establish a base line data on the possible consequences of gas flaring on these communities.

MATERIALS AND METHOD

Study Area

The map of the study area is shown in Fig. 1 and include Obite, Obrikom and Ebeocha, all in ONELGA, Orashi region of Nigeria.

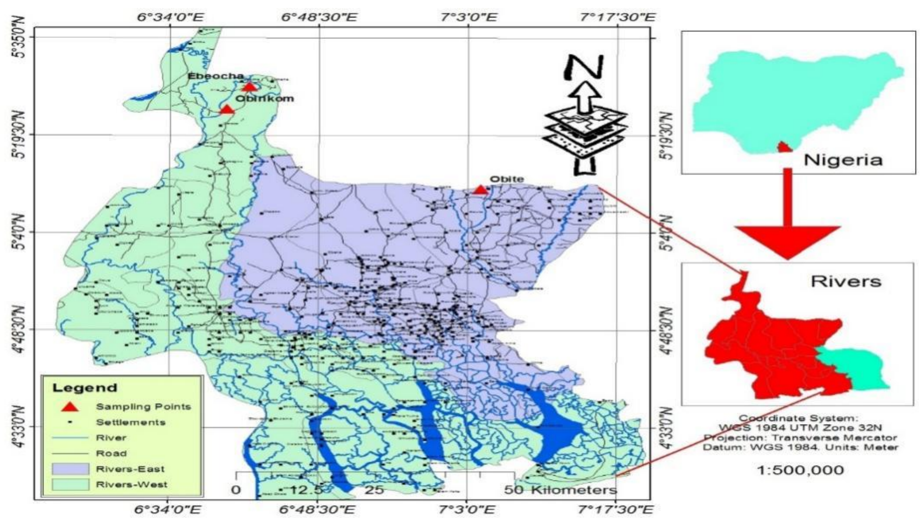

Fig. 1. Map of Rivers State showing study area

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Air Quality Measurement

Indices of air quality parameters were measured using Aeroqual air quality meter. Each individual parameter sensor was attached to the head of the meter (monitor). The meter was directed to the point source or towards the source of pollutant at 1.5m high. The meter was then initialized and zeroed, readings were taken and unit recorded in ppm (part per million) or mg/m^3. The following air quality parameters were measured.

Equipment	Model	Manufacturer
Aeroqual meter Sensor	S-205	Aeroqual
NO2	ENW 0304129-004	Aeroqual
SO2	EC 2003120-010	Aeroqual
CO	EC 0903120-020	Aeroqual
H2S	EH1 0102120-002	Aeroqual
VOC	EC 0107112-105	Aeroqual

Rain water sample collection

Water samples for this study were collected from rainwater during the rainy season in Obite, Obrikom and Ebocha communities of ONELGA, Rivers State. Free fall rainwater was collected with a water basin mounted on a support of 1.5m above the ground to avoid rain splashing effect. The funnel of the collector was filled with sieve to screen out insects and trap debris. The rainwater samples were stored for not more than 24 hours at a temperature of about 4 °C in a refrigerator prior to analysis.

Chemical Analysis of Rainwater

Chemical Analysis of Water Sample were measured using the following American Public Health Association (APHA) instruments as follows: pH (APHA 4500 H+), Conductivity/TDS (APHA-2540-C), Turbidity (APHA 2130B), Chemical Oxygen Demand (COD) (APHA 5220 B), Biochemical Oxygen Demand (BOD) (APHA 5210B), Heavy Metals (APHA 3030 E).(APHA , 2011).

Statistical Analysis

Data was analyzed using descriptive statistics with mean error. ANOVA (Analysis of Variance) were used for data analysis at 0.05 significant level. All analyses were done using SPSS (Statistical

Package for Social Sciences) version 21.0 was also employed in the statistical analyses.

RESULT

Variation in Air Quality

Table 1: Response Rate

Parameters	Obite	Obrikom	Ebocha	W.H.O
H_2S (µg/m^3)	0.061±0.0003	0.06±0.0001	0.00±0.0000	0.001
NO_2 (µg/m^3)	0.059±0.0004	0.059±0.0004	0.056±0.0004	0.06
SO_2 (µg/m^3)	0.013±0.0005	0.09±0.0052	0.186667±0.0089	0.10
VOCs (µg/m^3)	3112.67±129029.3	6495.33±3915984	5179.333±2694080	3899.1
CO (µg/m^3)	2.18±0.0217	2.22±0.0588	1.86±0.4501	1.00

Table 1 shows the result of the observation of air quality variation among communities of Obite, Obrikom and Ebocha. The mean error value of H_2S in Obite is 0.061±0.0003µg/m^3 below the exposure limit; in Obrikom is 0.06±0.0001µg/m^3 below the exposure limit and in Ebocha is 0.00±0.0000µg/m^3(not detected). This means that there is a slight variation in air quality among the three communities with no effect of H_2S on man and plants because the values are below the WHO standard limit (0.001) in this study.

The mean error value of NO_2 in Obite is 0.059±0.0004µg/m^3 below the exposure limit; in Obrikom is 0.059±0.0004µg/m^3 below the exposure limit and in Ebocha is 0.056±0.004µg/m^3 below the exposure limit. This shows very slight variation in air quality among the three communities with no effect of NO_2 on man and plants in this study.

The mean error value of SO_2 in Obite is 0.013±0.0005µg/m^{3}below the exposure limit; in Obrikom is 0.09±0.0052µg/m^3 below the exposure limit and in Ebocha is 0.1867±0.0089µg/m^3; indicating that there is significant variation in air quality among the three communities with slight effect on man and plants in this study.

The mean error of VOCs in Obite is 3112.67±1290.3µg/m^{3}below the exposure limit; in Obrikom is 6495.33±39156µg/m^3 higher than the exposure limit and in Ebocha is 5179.333±2694µg/m^3 higher than the exposure limit, which shows that the concentration of VOCs in the three communities is higher in Obrikom and Ebocha with slight effect on humans and plants while in Obite, it is below the exposure limit, control, hence, had no effect yet in this study.

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The mean error value of CO in Obite is 2.18±0.0217µg/m^{3}below the exposure limit; in Obrikom is 2.22±0.0588µg/m^3 below the exposure limit and in Ebocha is 1.86± 1.86±0.4501µg/m^3 below the exposure limit. These values are below the standard by WHO (1.00) hence has no effect on humans and plants. There is variation in air quality among the communities studied.

Variation in Rain water quality

Table 2: Heavy Metals Levels of Rainwater from Obite, Obrikom and Ebocha Communities

Parameters	Ebocha water sample	Obrikom water sample	Obite water sample
Cadmium, mg/L	BDL	BDL	BDL
Chromium, mg/L	BDL	BDL	BDL
Copper, mg/L	BDL	BDL	BDL
Iron, mg/L	0.029	BDL	BDL
Lead, mg/L	BDL	BDL	BDL
Zinc, mg/L	BDL	BDL	BDL
Control mg/L (WHO)	0.001		

Note:- BDL- Below Detection Limit (0.001mg/L or mg/kg).

The result in Table 2 shows that the heavy metals level of rainwater was below detection level or not detected. This means that as at the time of this study, the water quality tested, does not contain the presence of these heavy metals. This indicates that the communities of Obite, Obrikom and Ebocha have good drinking water with low level of impurities.

Variations in the physicochemical parameters in water samples

Table 3: Variations in the physicochemical parameters in water samples of the different communities in the study area

Parameters	Ebocha Water Sample	Obrikom Water Sample	Obite Water Sample
pH	6.98	6.95	6.94
Conductivity, (µS/cm)	11.60	12.58	11.78
Total Dissolved Solids, (mg/L)	6.15	6.67	6.24
Turbidity, (NTU)	0.14	0.08	0.08

The result in Table 3 shows the values of the physicochemical parameters in water sampled at the different communities of the study area.

The pH value obtained from the three communities had the mean value of 6.95, just a little above the control value of WHO (6.5), indicating that the water is of good quality in the communities studied. The study therefore revealed that the pH levels of rainwater is within the acceptable range to support both human and plants lives in this study.

Conductivity of the three study areas were low compared to WHO values (1,000 µS/cm). Ebocha had the value of 11.60 µS/cm, Obrikom (12.58 µS/cm) and Obite 11.78 µS/cm. The low values of conductivities in rainwaters could be due to effects of excessive cloud cover, release of antagonistic substances and massive evapotranspiration within theregion (Dami *et. al.,* 2012).

The values of Total Dissolved Solids (TDS) in the study were as follows: Ebocha (6.15); Obrikom (6.67) and Obite (6.24). This was extremely low when compared to WHO maximum allowable concentration of 1000 mg/L.

Turbidity values from Ebocha sampling station stood at 0.14 NTU while those of Obrikom and Obite was 0.08 NTU, being within the limit of acceptability.

Base Line Data on the Consequences of Gas Flaring from Obite, Obrikom and Ebocha Communities

The base line data is the reference point by some established agencies which indicate the state of the air or water in the area under study. WHO and Federal Ministry of Environment exposure limit are serving as the reference point in this study to show whether the area has negative or positive effect of air or rainwater on the residents. This is in line with the regulatory limits as stipulated by World Health Organization (WHO) and Federal Ministry of Environment in Nigeria (FMEnv). The base line data on the possible consequences of gas flaring in the three communities in Ogba/Egbema/Ndoni Local Government Area will remain the standard set already by WHO. This means that the limit set need not be altered in the area to continue to support lives.

DISCUSSION

Air quality in Obite, Obrikom and Ebocha Communities

The result of the study revealed that air quality is variable in communities of Obite, Obrikom and Ebocha. This is because very little amount of H_2S was detected in Obite and Obrikom but not detected in Ebocha; values of NO_2, is lower than the control value/standard value detected among Obite, Obrikom and Ebocha; Obite and Obrikom have mean values of SO_2 lower than the control value while Ebocha has value within the control value. Obite has mean concentration lower than the stated standard while Obrikom and Ebocha have mean concentration slightly higher than the control value of VOCs.

Mean value of CO was lowest in Ebocha followed by Obite and Obrikom. All of the values of CO were slightly higher than the control. This indicates significant variation in air quality in the communities studied. This is supported by Mbaneme *et. al.,* (2014) with values of 1.20-3.60 (2.43 ± 0.15) for CO in his study. Air quality parameters (such as SO_2, NO_2, H_2S, CO, VOC, SPM etc.) also showed higher concentration at test distances near the flare point and lower values at distances farther away from flare point. This is adduced to the prevalent abnormal air temperature; poor air quality, soil and rain-water acidity which characterized the selected gas flare locations. This is in line with Hassan & Kouhy (2013) who reported that ground level concentration of emitted pollutants from gas flaring is heavily influenced by distance from the flare as well as wind speed and direction s little is often known of its flame temperature. Specific site measurement, however, shows no evidence of acidification as a result of low concentrations of these anions. NO_2 emission concentration has been correlated with stroke (Anderson, 2012; Li et al, 2022). ANOVA statistics showed that the difference among the pollutants' characteristics at $p<0.05$ were statistically significant. These results align with those of Akuru (2012; Gobo et al, 2012; Giwa et al, 2014) who reported that gas flaring and other anthropogenic activities contribute to high levels of toxic gases like carbon monoxide ad particulate matter in some areas.

Rainwater quality in Obite, Obrikom and Ebocha Communities

Heavy Metals Level of Rainwater among the Communities

The result of the study on water quality analysis for heavy metals showed negative results or no presence of heavy metals detected in the three communities. This indicates that the level of pollution of water in the area has not gone bad to be harmful to whoever that drinks water in those communities. Low concentrations of heavy metals in this study were in consonance with the findings of Mbaneme *et. al.,* (2014) which ascertained that the levels of the pollutant gases and airborne trace metals were not significantly elevated above natural ambient levels in his work at Obrikom Community, Rivers State. Also, Oghenejoboh, (2005), found out that the concentrations of heavy metals (Pb, Zn, Cu and Cr) in the air were considerably low in his study at Afiesere, an oil producing community in the Niger Delta area of Nigeria.

Physicochemical parameter Levels of Rainwater in the Communities

The result showed that the pH levels of rainwater is normal in the study. This is because the pH values obtained from Obite, Obrikom and Ebocha are within the established standard that allows the water not to be pronounced as too acidic or basic for human usage at home and in the farm. Hence, the pH value is within the acceptable limit for usage. This finding is not in agreement with the work of **Tawari** & Abowei (2012) in Niger Delta, Nigeria, who stated that pH of 5.98 and 6.68 in dry and wet seasons respectively, were higher than the acceptable ambient air limits specified by the Federal Ministry of Environment (FMEnv) and Department of Petroleum Resources (DPR), Nigeria.

Conductivity of the three study areas varied from 11.60 µS/cm to 12.58 µS/cm with Obrikom having the highest value. This result was not at parity with Ezenwaj, *et. al.,* (2013) that researched on effects of gas flaring on rainwater quality in Bayelsa State, Eastern Niger-Delta region, Nigeria and had conductivity values that ranged from 45 – 74 µS/cm. All the same, these studies were within WHO maximum allowable concentration of 1000 µS/cm. In another work by Dami & Ayuba (2012) in Delta State, Nigeria, the conductivity was highest at Okpai during wet season with an average value of 26.08µs/cm and closely followed by same Okpai during dry season with a value of 25.723µs/cm. At Beneku, dry and wet season average values were 17.927 and 17.643 respectively. The maximum permissible limit of 1,000µs/cm was not met by all values under study. Significant differences at $p<0.005$ existed between Okpai and Beneku but none were noticed between dry and wet seasons in both study areas. Higher conductivity values at Okpai rainwaters as compared to Beneku during both seasons could be due to high amounts of dissolved salts and higher evapotranspiration of water. The low values of conductivities in rainwaters could be due to effects of excessive cloud cover, release of antagonistic substances and massive evapotranspiration within the region (Dami & Ayuba, 2012).

The values of Total Dissolved Solids (TDS) in the study ranged from 6.15 to 6.67 with Obrikom having the highest value indicating that the rainwater is safe for consumption. This was extremely low when compared to WHO maximum allowable concentration of 1000 mg/L and Dami & Ayuba, (2012), which had the highest value at Okpai during dry season (15.933 mg/l); Okpai during wet season (15.163 mg/l); 10.02 mg/l and 8.933 mg/l were then observed for Beneku dry and wet seasons respectively. However, WHO (2003) recommended less than 1000 mg/l as the maximum permissible value for TDS in drinking water. All values were below the acceptable limit. There were significant differences at $p<0.05$ level of significance between Okpai and Beneku as well as between dry and wet seasons. Higher TDS values at Okpai during both seasons as compared to Beneku could be due to the release of hydrocarbons into the atmosphere through gas flaring. Based on TDS as a criterion, rain waters of both studied sites and during both seasons are safe for consumption.

Turbidity values from Ebocha sampling station stood at 0.14 NTU while those of Obrikom and Obite was 0.08 NTU, being within the acceptable limit. The findings were lower than the values gotten by Odjugo, (2011) which had the mean turbidity for the year (6.54 NTU) and that of dry season (9.58 NTU) exceeded the acceptable limit of 5 NTU, but the mean rainy season (4.91 NTU) was within the limit. For 8 months (October – May) turbidity was higher than the acceptable limit putting the compliance level at 33.3%.

Comparison of the Values of Air and Rainwater with the Control

The evaporation of Carbon, Nitrogen, Oxygen, Sulphur etc., into the atmosphere cause the suspension of particles that cause air pollution. During rain, the mixture of some of these particles present in the atmosphere causes acid rain, which is indicated by the levels of the pH values. The pH value of rainwater being polluted is slightly higher than the WHO standard limit and Federal Ministry of Environment exposure limit.

CONCLUSION AND RECOMMENDATIONS

The results in this study revealed that air and rainwater qualities of Obite, Obrikom and Ebocha communities within gas flaring stacks of ELF-Total and Nigeria Agip Oil company (NAOC) in Ogba/Egbema/Ndoni Local Government Area of Rivers State were of low values and below WHO standard limits at the time of the study. Thus, gas flaring is believed to have cause minimal air pollution, which as at the time of this research, may not lead to acid rain with its life-threatening effects.

Based on the result of the research, the authors make the following recommendations:

1. The federal government should reinforce and strengthen the policy of environmental pollution to reduce the rate at which humans carry out their activities indiscriminately.
2. Federal government should create tax-force on the wrong way of burning or causing air pollution to the environment to reduce the rate of generating air pollutants to extend human life-span.
3. State government should liaise with the paramount rulers of different communities to checkmate the level of lawlessness (e.g. pipeline vandalization / sabotage and bunkering activities, etc.) to reduce the amount of different elements that causes pollution of the environment.
4. The oil companies operating in the area should adopt improved gas flaring strategy/plans to reduce the levels of pollutants discharged into the atmosphere, e.g. by trapping the flared gases for another energy supply/usage.

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