IMPACT OF MINING ACTIVITIES ON THE AIR QUALITY OF SELECTED MINIG SITES IN SOME LGAs IN TARABA STATE

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Abstract: Globally, there is now substantial concern about the consequences that mining operations have on the Air. This study aims to explore the effects of mining activities on the air quality at three mining sites in Taraba state: the sites for quartz, barite, and quarry, respectively. Three (3) locations in three (3) replicates at three (3) sites provided air samples for the investigation. NESREA and WHO provided the primary environmental study parameters for audits and impact assessments. Three locations within each of the Brite and Quartz mining site—the mining pit, 50m away from the pit, and 100m away from the pit—were used for ambient air monitoring. Control sample was taken at 3km away. At the generator house, crushing site, and blasting site, quarry samples were collected. Gas analyzers, specifically the Gasman models 19648H, 19831N, 19502H, 19252H, 19730H, 19812H, and 19773H, were employed in the field to measure the concentrations of SO_2, NO_2, H_2S, CO, NH_3, Cl_2, and HCN gases. The study showed that, at the Quarry location, every measured parameter—aside from CO—compared significantly higher in amount to the NESREA and WHO allowed limits, with a significance level of $p<0.05$. The Barite Mining Site also revealed a substantial difference in all measured parameters with NESREA and WHO values $p<0.05$, with the exception of NO_2, which displayed equivalent measurements with the two standards (NESREA and WHO) permissible limits at $p>0.05$. When compared to the WHO and NESREA permitted limits, all parameters at the Quartz Mining Site compared significantly higher. The investigation verifies a decline in the surrounding ambient air quality of the mining areas in Taraba State. This study recommends that: local miners should regularly receive proper education about environmental pollution arising from mining activities so that they are aware of the consequences of their activities; environmental bodies like NESREA should strictly regulate the level of Noise and emission of gaseous substances to the air at mining sites.

Key Words: Air, air quality, mining, NESREA, WHO

Introduction

Since the inception of industrialization, humans have continued to introduce hazardous materials into the environment at a very alarming rate. These hazardous materials, mostly consisting inorganic substances (heavy metals), pose high environmental and health threat (Warhurst, 2019). The resulting impact of the materials occasioned by these acts is so enormous. In abandoned or unreclaim mining sites, these tailings contain heavy metals spread through tens of hectares of land via Aeolian dispersion and water erosion for hundreds of years (U.S. Environmental Protection Agency (USEPA) 2004; Warhurst, 2019). As a rising global attraction, Nigeria has for decades experienced this environmental degradation, owing to exploration activities. Although it is a major source of revenue for many developing nations, the effects of mining on the environment have been debilitating because it naturally and gradually destroys the immediate environment by producing high amounts of hazardous wastes that leave a long-time deleterious impact. This has been a core issue compared to the developed society where in-pit storage, backfilling, co-disposal and dry-stacking facilities are used by industries and are required by law to remedy or contain tailings piles (Gonzalez and Gonzalez-Chavez 2006). As a multi-faceted activity which incorporates local, small- and large-scale industrialists, it renders adverse environmental, health and socio-economic effect to immediate communities and the world at large.

The deteriorative effects of mining activities to the Air, land, runoffs and vegetation including forest ecosystems have become a matter of serious concern the world over (Ugya *et al*., 2018). Mining which is one of many anthropogenic activities has altered the landscape and has led to loss in biological and landscape diversity characterizing the land with mined ponds, pilot ponds, reservoirs, mine dumps and mounds, resulting in the loss of its aesthetic value. The waste products of mining activities are a bone of contention due to the large quantities produced and the presence of toxic elements (Kitula, 2006). One common negative effect of mineral excavation from the earth's surface is the destruction of its natural landscape, by creating open spaces in the ground and producing heaps of rock wastes that cannot be easily disposed. The impact of mining activities causes rapid and drastic environmental changes due to the complex problems and frequent changes in the landscape in the mining area, and monitoring these environmental changes is becoming more difficult (Ugya *et al*., 2018).

Mineral resources of course, are valuable natural assets of a nation, and palaeontological evidence and information have shown that since man's existence, minerals have been taken from the earth and used to better life. This may imply that for ages, man has been modifying parts of his environment in an attempt to make his living more comfortable. In some instances, these activities have resulted in the pollution of his immediate environment to a dangerously high level (Ugodulunwa and Taiwo, 1997).

Air pollution

The processes of blasting and crushing releases large amounts of fine particles dispersed by wind. These tiny dust particles are very minute and mostly less than 10 microns. When present in ambient air as airborne particulate matter (PM), they pose health threat humans. As derivatives of marble and granite processing, Ndinwa, (2014) in Auchi Edo state reported its debilitating role on the poor quality of nearby vegetable gardens grown around factories or mining sites. At maximum levels of exposure (by inhalation); respiratory disorders, silicosis, and lung diseases manifest due to occupational hazards (Nnabo and Taiwo, 2001). There are no doubts the gold mining activities in Zamfara, Oyo, Ishiagu and Anyigba, is the major cause of silicosis and silico-tuberculosis in the mining areas where dust from the mining sites have high silica content (Akabzaa and Darimani, 2001). Sulphur dioxide (SO2), nitrogen dioxide (NO_2), carbon monoxide (CO) and black smoke at sufficient exposure can exacerbate the condition of people with asthma and arthritis. The release of dust particles into the environment in all stages of coal mining activities in Maiganga has been found to be so enormous, as it increases during the dry season when large amounts of dust is usually generated due to strong wind (Wu and Liu, 2011). The Discharge of volatile elements and compounds as byproducts of combustion releases large amounts of pollution into the environment and trigger health condition such as pneumoconiosis (Chen *et al*., 2014). In Sagamu and Ewekoro, Ogun state, reports of residents living with eye pain, asthma and respiratory attack of all kinds have since emanated from adjacent community owing to the activities of industries (cement factory) and mining operations (Aigbedion, 2005).

Materials and Method

Investigated parameters will be majorly drawn from NESREA and WHO major Environmental investigated parameters for Audits and Impact assessments.

Sampling Site

Taraba is a northeastern State in Nigeria. It is located between latitude 6˚25'N and 9˚30'N and between longitudes 9˚30'E and 11˚45'E. The state is bordered on the west by Nassarawa and Plateau States, to the north by Bauchi and Gombe States and to the northeast by Adamawa State. According to the 2006 National Population Census, the population of Taraba state was 2,300,736 (1,199,849 (52.2%) males and 1,100,887 (47.8%) females). The state's population growth rate is about 3.1% per annum. The state is the most ethnically diverse state in Nigeria with over 80 different ethnic groups.

The States climatic types that range from northern equatorial type in the southern part of the state (Kurmi, Ussa and Takum LGAs) to the Tropical hinterland type (Donga, Gashaka and Wukari LGAs) to Tropical continental type of climate in the northern part of the State (Yorro, Zing, Lau, Jalingo and Ardo Kola LGAs). The Mambilla area is a montane climate type. This climatic type has greatly influenced the vegetation types in the state. The vegetation types ranges from the tropical rainforest around Kurmi, Ussa and Takum LGAs to Guinea savannah in the central part of the state and Sudan savannah type in the northern part. Montane vegetation is found on the Mambilla plateau and Shebshi mountain and flood plain complex is found along the major rivers in the state.

Air Sampling Locations

The Air samples for the study will be obtained from three points, in three replicates, at three sites in three Local government areas within the State namely:

i. Barite mining site at Dogon Yasu, Bali LGA.
ii. Quartz mining site at Jamtari, Gashaka LGA.
iii. Quarry site at Sibre, Ardo-Kola LGA.

Air Analysis

Ambient air sampling was carried out at 3 points within each mining site i.e mining pit, 50m away from the pit, and 100m away from the pit. Control sample was taken at 3km away from the mining site in line with A.G Benibo et al 2020. Quary samples were taken at the blasting site, crushing site and generator house. Gas analysers; Gasman models 19648H, 19831N, 19502H, 19252H, 19730H, 19812H, 19773H, were used to determine levels of SO2, NO2, H2S, CO, NH3, CL2, and HCN gases respectively, directly on the field. NM 102 Noise level Meter was used to determine Noise level. Temperature, wind speed, and relative Humidity were determined by MAX-MIN Thermometer, MASTECH MS6252A Digital Anemometer and MAX-MIN Hygrometer model KTJTA318 respectively. PM2.5, PM10, TVOC and CH2O were determined directly on field by the use of a handheld Air Ae Steward Air Quality monitor

Results

The results of gaseous air quality analysis are shown in Table 1, 2 and 3, in each case were compared with permissible limits of NESREA and WHO. At Quarry site, all the measured parameters exception of CO in the three study sites compared significantly higher in quantity compared to the NESREA and WHO permissible limits $p<0.05$. Similarly, at the Barite Mining Site all the measured parameters compared significantly higher in all three sites with the NESREA and WHO values $p<0.05$, except No2 which showed similar measurement with the two standard (NESREA and WHO) permissible limits at $p>0.05$. At Quartz Mining Site, all parameters compared significantly higher when compared to NESREA and WHO permissible limits.

Table 4 shows the measurements of Noise Levels within three sites in the study area, At Quarry Site, Noise level, Minimum noise level and Maximum noise level showed that sites AQ1, AQ2 and AQ3 all had similar levels that compared significantly higher to both the control level and the FME limits $p<0.05$. Similarly, At Barite Site, values compared significantly higher to the control but compared significantly lower to the FME limits. Similarly, at Quartz site values compared significantly higher to the control but compared significantly lower to the FME limits.

Table 5 shows field meteorological measurements at the study site. With respect to, Quarry Site. All parameters were similar to the control $p>0.05$, except Wind Speed which showed significant difference $p<0.05$. The wind speed was lower in AQ1, AQ2 and AQ3 compared to the control. At Barite Site, only Rel. Humidity and wind speed showed significant difference with the control. The relative humidity was higher in all the sites compared to the control. The wind speed in AQ2 was similar with the control, while AQ1 and AQ3 were similar but significantly lower to the control $p<0.05$. At Quartz Site, similarly, only relative humidity and wind speed showed significant difference $p<0.05$. The relative humidity in AQ1, AQ2 and AQ3 all compared significantly lower to the control site, while in the wind speed Aq1 compared similar to the control, while AQ2 and AQ3 both compared significantly lower to the control.

Table 1: Air Quality Measurements at Quarry Site in different sampling points

Samples	**NO2 (µg/m^3)**	**SO2 (µg/m^3)**	**H2S (µg/m^3)**	**CO (µg/m^3)/ 8hr**	**CO2 (µg/m^3)**	**NH3 (µg/m^3)**	**Cl2 (µg/m^3)**	**HCN (µg/m^3)**	**TVOC (mg/m^3)**	**CH2O (mg/m3)**	**PM2.5 (µg/m^3)**	**PM10 (µg/m^3)**
AQ1	96±100^{a}	104±0.150a	110±60a	6000±361a	1300±110a	200±6.43a	400±100a	2670±0.58a	2.326±0.18a	0.278±0.03a	89.667±45.71a	315.667±29.01a
AQ2	105±150^{b}	99±120b	100±80a	6330±252b	1360±160b	600±1730b	270±120b	1330±0.58b	1549.00±408.63b	0.293±0.01b	49.00±56.35b	363.667±53.8b
AQ3	89±260^{b}	110±290c	81±120a	74330±115c	1390±1700c	900±1730c	370±60a	1170±0.29c	2.904±0.16c	0.289±0.04c	33.667±25.7c	388.667±21.50c
Control	85.0±6^{a}	90±6.0d	82±100c	5330±580d	1100±100ef	300±1150d	370±60a	1330±0.58d	0.893±0.33d	0.153±0.07d	21.333±8.50d	233.333±39.12d
NESREA	80±0.00^{c}	80±0.00d	80±0.00c	5000±0.00d	**1000.0±0.00e**	290±0.00e	300±0.00b	1000±0.00e	300.0±0.00e	NA	20.0±0.00e	60.0±0.00e
WHO	10±0.00^{d}	40±0.00f	20.00±0.0d	9000±0.00e	**1000.0±0.00f**	840±0.00f	1000±0.00c	4700±0.00f	250.00f	0.20±0.00e	5.00±0.00f	15.0±00f
F	**17.564**	**53.739**	**31606.127**	**138.857**	**240.284**	**23.836**	**62.010**	**196.763**	**41.301**	**3.554**	**31.366**	**78.880**
p-value	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.033**	**0.001**	**0.001**

Result is significant were $p<0.05$; Means under the same column tagged with different letter alphabet are significantly different; Values and mean ± SD; AQ1=Blasting Area, AQ2=Crushing Area, AQ3=G generator House

Table 2: Air Quality Measurements at Barite Mining Site in different sampling points

Samples	NO2 (µg/m^3)	SO2 (µg/m^3)	H2S (µg/m^3)	CO (µg/m^3)	CO2 (µg/m^3)	NH3 (µg/m^3)	Cl2 (µg/m^3)	HCN (µg/m^3)	TVOC (mg/m^3)	CH2O (mg/m3)	PM2.5 (µg/m^3)	PM10 (µg/m^3)
AQ1	120±0.06	100±100	99±60a	7330±1150a	1700±146.37A	870±1150A	567±120a	708±1.00a	2.014±0.31a	0.245±0.08a	87.67±15.14a	89±58.62a
AQ2	90±0.06	93±60a	43±12b	4330±580b	1600±23.29b	670±580b	233±120b	600±0.00b	0.64±0.05b	0.120±0.02b	93.67±7.57b	85.00±31.43b
AQ3	88±0.12	89±60b	33±12b	5070±580c	1500±21.55c	370±580c	167±60c	500±0.00b	0.354±0.03c	0.081±0.02c	76.67±4.73c	73.67±7.23c
Control	81±1.16	88±60c	67±120d	5000±1730d	1300±36.53d	300±1150D	133±60c	1000±0.00b	0.387±0.07c	0.053±0.01c	37.00±11.79c	65.67±11.68d
NESREA	80±0.00	80±0.00c	80±0.00c	5700±0.00d	1000±0.00e	290±0.00d	300±0.00d	1000±0.00b	300.0±0.00d	NA	20.0±0.00d	60.0±0.00e
WHO	10±0.00	40±0.00d	20.00±0.00d	9000±0.00f	1000.0±0.00e	840±0.00f	1000±0.00e	4700±0.00c	250.00±0.00e	0.20±0.00d	5.00±0.00e	15.0±00f
F	**1.058**	**25.735**	**70170.560**	**63.718**	**38.994**	**23.119**	**71.913**	**231.870**	**263.021**	**21.210**	**178.264**	**60.593**
p-value	**0.430**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**

Result is significant were $p<0.05$; Means under the same column tagged with different letter alphabet are significantly different; Values and mean ± SD.

Table 3: Air Quality Measurements at Quartz Mining Site in different sampling points

Samples	NO2 (µg/m^3)	SO2 (µg/m^3)	H2S (µg/m^3)	CO (µg/m^3)	CO2 (µg/m^3)	NH3 (µg/m^3)	Cl2 (µg/m^3)	HCN (µg/m^3)	TVOC (mg/m^3)	CH2O (mg/m3)	PM2.5 (µg/m^3)	PM10 (µg/m^3)
AQ1	93±4a	93±0.5a	100±0.06	5000±5.57a	1400±13227a	200±1.00a	200±34a	1667±0.58a	1.123±0.09a	0.216±0.03a	51.67±4.51a	89.667±13.01a
AQ2	87±6b	67±120b	97±0.06a	3000±2.00b	800±21550b	367±1.15b	33±12b	1333±0.58a	0.718±0.06b	0.114±0.01a	55.00±12.00b	84.667±0.0b
AQ3	81±60b	33±60c	87±0.00a	4333±0.58c	900±60210c	3333±0.58c	<100±0.0b	<333±1.15b	0.635±0.04b	0.089±0.01a	71.667±7.37c	62.00±7.81b
Control	33±12c	40±2d	83±0.15b	2333±0.58d	700±52700d	301±1.53d	267±0.06c	1008±1.00c	1.804±0.41a	0.243±0.04b	33.31±5.51b	71.333±17.79a
NESREA	80±0.00d	80±±0.00e	80±0.00c	5700±0.00e	1000.0±0.00e	290±0.00e	300±0.00d	1000±0.0d	300.0±0.00c	NA	20.0±0.00d	60.0±0.00c
WHO	10±0.00e	40±0.00f	20.00±0.0d	9000±0.00f	1000.0±0.00f	840±0.00f	1000±0.00e	4700±0.00e	250.00d	0.20±0.00c	5.00±0.00e	15.0±0.00d
F	**9.330**	**19.478**	**34419.280**	**11.561**	**116.380**	**100.596**	**704.410**	**130.098**	**1449.733**	**53.214**	**563.890**	**534.612**
p-value	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**

Result is significant were $p<0.05$; Means under the same column tagged with different letter alphabet are significantly different; Values and mean ± SD

Table 4: Measurements of Noise Levels

		Noise [dB(A)]		
Variables	**Sample code**	**Noise level**	**Minimum noise level**	**Maximum noise level**
Quarry Site	AQ1 (Blasting Area)	95.033±5.62^a	82.667±7.59^a	104.533±5.85^a
	AQ2 (Crushing Area)	95.7±3.12^a	90.133±1.95^a	106.367±7.39^b
	AQ3 (Generator House)	92.2±2.3^a	81.933±3.11^a	102.133±5.76^c
	Control	68.667±2.53^b	59.167±8.95^b	75.233±2.5^d
	FME limit	90.0±0.00^b	90.0±0.00^b	90.0±0.00^d
	F	**35.612**	**15.994**	**20.000**
	p-value	**0.001**	**0.001**	**0.001**
Barite Site	AQ1 (Mining Pit)	78.433±2.91a	69.767±4.32a	83.333±4.72a
	AQ2 (50 m away from the pit)	64.8±2.23b	58.9±1.35b	71.8±2.96b
	AQ3 (100 m away from the pit)	57.8±2.25c	48.7±3.18c	65.433±2.80c
	Control	51.7±3.68d	39.567±0.96d	63.467±2.55d
	FME limit	90.0±0.00^e	90.0±0.00^e	90.0±0.00e
	F	**113.816**	**182.308**	**43.679**
	p-value	**0.001**	**0.001**	**0.001**
Quartz Site	AQ1 (Mining Pit)	69.9±0.87a	60.467±3.80a	80.4±2.05a
	AQ2 (50 m away from the pit)	69.9±0.87b	60.467±3.80a	80.4±2.05a
	AQ3 (100 m away from the pit)	58.1±2.35c	48.233±4.86b	67.567±4.52b
	Control	52.5±4.95d	39.1±1.61c	67.333±2.95c
	FME limit	90.0±0.00^e	90.0±0.00^d	90.0±0.00d
	F	**83.625**	**125.322**	**35.265**
	p-value	**0.001**	**0.001**	**0.001**

Result is significant were $p<0.05$; Means under the same column tagged with different letter alphabet are significantly different; Values and mean ± SD

Table 5: Field Meteorological Measurement

Variables	Sample code	Temperature (°C)	Rel. Humidity (%)	Pressure (kpa)	Wind Speed (m/s)
Quarry Site	AQ1 (Blasting Area)	32.167±0.61	69.067±0.76	1010.333±0.12	0.973±0.2a
	AQ2 (Crushing Area)	33.467±0.25	65.433±0.21	1010.667±0.06	0.537±0.38a
	AQ3 (Generator House)	33.567±0.15	67.733±0.06	1012.367±0.15	1.163±0.07b
	Control	34.267±0.15	65.3±0.1	1012.667±0.12	1.18±0.32b
	FME	31.4-31.7	73.4-73.5	1012.3	0.93-1.45
	NESREA	<25.5	<70	1013.25	1.3
	F	**0.625**	**0.322**	**125.265**	**9.265**
	p-value	**0.832**	**0.778**	**0.422**	**0.002**
Barite Site	AQ1 (Mining Pit)	34.667±0.15	64.367±0.12a	1012.267±0.15	0.37±0.06a
	AQ2 (50 m away from the pit)	35.4±0.2	63.567±0.06b	1012.367±0.12	1.55±0.36b
	AQ3 (100 m away from the pit)	35.633±0.12	61.533±0.15c	1012.533±0.15	0.513±0.34a
	Control	36.433±0.12	60.333±0.15	1012.633±0.15	1.093±0.15b
	FME	31.4-31.7	73.4-73.5	1012.3	0.93-1.45
	NESREA	<25.5	<70	1013.25	1.3
	F	**2.731**	**8.239**	**1.428**	**8.033**
	p-value	**0.531**	**0.044**	**0.627**	**0.041**
Quartz Site	AQ1 (Mining Pit)	33.367±0.06	68.7±0.20a	1012.433±0.06	1.907±0.15a
	AQ2 (50 m away from the pit)	33.267±0.15	70.333±0.06b	1012.4±0.1	0.883±0.15b
	AQ3 (100 m away from the pit)	31.333±0.15	72.733±0.15c	1012.633±0.15	0.54±0.19c
	Control	31.533±0.15	73.3±0.200d	1012.433±0.15	1.14±0.27a
	FME	31.4-31.7	73.4-73.5	1012.3	0.93-1.45
	NESREA	<25.5	<70	1013.25	1.3
	F	**1.601**	**16.051**	**1.921**	**8.261**
	p-value	**0.129**	**0.001**	**0.426**	**0.034**

Result is significant were $p<0.05$; Means under the same column tagged with different letter alphabet are significantly different; Values and mean ± SD

Discussion

Quarrying and crushing are a global phenomenon and have caused widespread concern throughout the world, including developed countries, Quarrying has become critical in several developing countries, including Nigeria, Quarry resources are an essential source of income for a country, but they must first be explored, mined, and processed before they can be used which comes with Various sorts of environmental harm,risks and pollution (Ezekwe et al., 2012; Ibeh et al.,2012; Anand, 1999; Aigbebion, 2015). Table 1, 2 and 3 shows Air Quality Measurements at Quarry Site, Barite site and Quartz site respectively sampled from different stations AQ1, AQ2 and AQ3. At the Quarry site, AQ1 was the Blasting Area, AQ2 was the Crushing Area and AQ3 was the Generator house. The results of gaseous air quality analysis revealed that NO2, SO2, H2S, CO2, CH2O, PM2.5 and PM10 exceeded NESREA and WHO permissible limits at Quarry Site (table 1). NH3 and Cl2 exceeded NESREA limit but were within the permissible limit for WHO. HCN, CO and TVOC were below the NESREA and WHO permissible limit. The excesses of these gaseous pollutant in the atmosphere within the study sites is no surprise as their excesses may be the result of the mining activities there. The pollution of these sampling sites occurs in the following order AQ1>AQ2>AQ3. While the elements polluted the ambient air in the following order CO_2> H_2S> SO_2> NO_2> PM10> PM2.5> CH_2O. The trend of these finding is similar with other studies (Okafor *et al.,* 2023; Bada *et al.*, 2013; Ag & Sha'Ato, 2020; Ghose & Majee, 2001).

At the Barite site, AQ1 was the Mining Pit, AQ2 was 50m away from the pit while AQ3 was 100m away from the pit. The results of Air Quality Measurements (AQM) at the Barite site shows that SO2, H2S, CO2, NH3, PM2.5, PM 10 all exceeded NESREA and WHO permissible limit. Co exceeded NESREA limit but fell within the WHO permissible limit. CL2, HCN, TVOC and CH2O all had values that were below the permissible limit for NESREA and WHO. There was a progressive increase in parameters from AQ1 down to AQ3 and AQ1>AQ2>AQ3, indicating a decrease in the pollution of the air as we move away from the mining pit (table 2).The AQ1 had more air pollutions of these gases due to crushing activities which is at the open

mining Pit where materials are excavated from an open pit; it is one of the most common CO, CO2, Cl2, TVOC, and CH2O were all below NESREA and WHO limit (table 3).
The measurements of Noise Levels within the three sites in the study area shows that, At Quarry Site, Noise level, Minimum noise level and Maximum noise level shows that AQ1, AQ2 and AQ3 all had similar levels that compared significantly higher to both the control level and the FME limits. Similarly, At Barite Site, values of aforementioned compared significantly higher to the control but compared significantly lower to the FME limits. Similarly, at Quartz site values compared significantly higher to the control but compared significantly lower to the FME limits, this implies that only at quarry site that the noise level was in excess of the FME limits. This finding is similar to a study done by Nwachukwu et al., 2021 in Ebonyi southeast, Nigeria where found out that the noise level was above the FME limit and compared significantly higher in the mining area within varied distance, similarly a study by Manwar *et al*., 2016 in India had noise level at the crushing pit and generator house to significantly higher compared to the FME limit.

Noise levels emanating mainly from the generator and mining machinery (Viz generator house, crushing area, blasting area) pose high levels of noise which are responsible for the increasing incidence of deafness among miners using machinery in their operations. Ambient noise levels of ~ 90d BA considered tolerable in this study (FME, 2007). The noise levels recorded in all tested locations in the study locations did not exceeded the FME limit of 90dBA, which is the level recommended for ambient air except at the Quarry site. WHO guidelines recommend noise levels of 30-35 dBA for undisrupted sleep. The adverse effects of noise are dangerous enough that noise problem is next crime by certain countries. Table 4 shows field meteorological measurements at the study site. With respect to, Quarry Site. All parameters were similar to the control, except Wind Speed which showed significant difference, the wind speed was lower in AQ1, AQ2 and AQ3 compared to the control. At Barite Site, only relative humidity and wind speed showed significant difference with the control. The relative humidity was higher in all the sites compared to the control. The wind speed in AQ2 was similar with the control, while AQ1 and AQ3 were similar but significantly lower to the control At Quartz Site, similarly, only relative humidity and wind speed showed significant difference. The relative humidity in AQ1, AQ2 and AQ3 all compared significantly lower to the control site, while in the wind speed AQ1 compared similar to the control, while AQ2 and AQ3 both compared significantly lower to the control.

Conclusion

The study has confirmed the deterioration of ambient air quality in and around Dogan Yasu community in Taraba State. The results of gaseous air quality analysis revealed that criteria pollutants such as NO_2, SO_2, H_2S, CO_2, NH_3, PM2.5 and PM10 exceeded NESREA and WHO permissible limits at the study sites relative to the others. Only quarry site had a noise level in the three stations that was significantly higher than the control and the FME limits. Temperature exceeded the FME and NESREA limit in all study sites. Relative humidity was exceeded in quartz site while wind speed was below the FME and NESREA limits. The proper regulatory mechanism to the level of emission of gaseous substance to the air, heavy metals and noise should be strictly regulated by environmental bodies like NESRE, proper education about environmental pollution arising from mining activities should be frequently giving to local miners to be conscious of the consequences of their activities.

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