

Environmental and health risk implications of air quality in the vicinity of the Port Harcourt Airport road dumpsite

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ABSTRACT: This study examines environmental and health risk implications of air quality in the vicinity of the Port Harcourt airport road dumpsite. The study objectives are to determine air quality in the vicinity of the Port Harcourt airport road dumpsite of the municipal solid waste, examine the health risk implications of air quality in the study location, ascertain the environmental implications of the air quality in the vicinity of the dumpsite, and identify if there are variations in air quality in the different sections in the study location. Air quality was determined using standard operating procedures where samples were collected at the dump, 250 m and 500 m away from the dumpsite. The samples were collected in the morning, afternoon and evening hours of the same day. The samples collected from these locations were taken in-situ amongst which are (CO₂, CH₄, O₂, CO, H₂S, PM-2.5, PM-10, Ni, Cr, Temperature and RH). Survey questionnaire was administered, in order to complement the field results. Three hypotheses were also tested using ANOVA and the Chi-square analytical tool. The findings of the study show that Nickel and Chromium amongst other parameters were above the WHO standard limits. Therefore, the quality of air within the vicinity of the dumpsite is considered polluted. Consequently, URTI and skin rashes are the common ailments that are prevalent in the area of study. Thus, the municipal solid waste dumpsite constitutes both environmental and health implications to the human population within the vicinity of the Port Harcourt airport road dumpsite. In this regard, this study recommends that the citing of waste dump should be done in line with standard regulations and prohibits the development of residential settlements within 3 km radius from any dumpsite.

Keywords: Air quality, environmental and health risk, municipal solid waste dumpsite, Port Harcourt airport road, residential settlements.

INTRODUCTION

Air contamination is a noteworthy worry globally, and this has a genuine toxicological effect on human wellbeing and nature. It has various diverse emanation sources, yet engine vehicles and modern industrial practices contribute significantly to the pollution of air. As indicated by the World Health Organization (2014), six noteworthy air contaminations incorporate molecule contamination, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Long and momentary introduction to air suspended toxicants has an alternate toxicological effect on human including respiratory and

cardiovascular maladies, neuropsychiatric entanglements, the eyes aggravation, skin illnesses, and long haul incessant sicknesses (Kevin, 2018).

The term breathing simply put connotes the act of ventilation of the lungs, a procedure which makes gas trade admission of oxygen into the body and the retrieval of carbon dioxide from the body into the earth increasingly productive. The development and constriction of the chest in people is the remotely obvious pointer of the gas trade process. Living creatures need to acquire oxygen so as to breathe properly (Millican and Barker, 1997).

Piles of waste and rubbish have become normal sight in the state capitals and urban territories of Nigeria (Igwe et al., 2013). So far, untreated waste (metropolitan, mechanical and horticultural waste and so forth) are been discharged into the urban centres daily and this have brought about conditions which lead to extreme contamination and interruption of the normal environmental quality of the urban centres (Ezeifeoma, 2004 as cited in Njoku, 2015). The issue of waste has today turned out to be one of the genuine ecological issues confronting the most nations of the world because of its potential ability to cause contamination in the regular habitat (water, air, land), corrupt structures and landmarks (decrease in stylish esteem), and also represent a great deal of perils to human wellbeing and the characteristic assets of both social and monetary significance.

Brudtland Commission (2007) implied that contamination is a type of waste and a side effect of wastefulness in modern creation. So, if appropriately put, one can say that waste and contamination got connected at the hip since the nearness of the previous lead to the event of the last mentioned. In any case, air contamination is presentation of vaporous or suspended particulate issue into the environment from waste dumpsites that encroaches on the encompassing air quality. This could be as a result of characteristic or anthropogenic activities; although in nature, the composition of air is typically dictated by the amount of contamination.

Air pollution has been identified to be very poisonous to human and environmental health because it is deadly and its effects is felt by plants, animals and human and have the capacity to destroy the ecosystem which is a major anchor for human existence (Ogunji et al., 2004). Presently, waste management is a global issue which is not just limited to only urban centres but also in the rural areas especially in third world countries. It is an obvious fact that the establishment of waste dumpsites in some cases are not done following laid down procedure which at present have turned to a death trap especially for inhabitants around such areas (Agunwamba et al., 2016). This has brought about poor management of waste with the new trend of waste disposal along major roads and street, unapproved open dumpsites.

However, the introduction of materials either in solid or gaseous form into the atmosphere that is harmful to human health and undermines the quality of the environment is termed air pollution. This phenomenon arises from anaerobic process from waste dumpsites, harmful pollutants are released into the air and this could pose serious threat to life especially where the waste dumpsites are located within or close to residential apartments. According to Hassan and Abdullahi (2012), some of these pollutants include Carbon monoxide (CO), Sulphur dioxide (SO₂), Hydrogen sulphide (H₂S), Methane (CH₄), Nitrogen dioxide (NO₂), Ammonia (NH₃), Particulate Matter (PM10), and others.

Although it is well known fact that particulate matter to

be specific can be seen amongst soot and dust but some others are not visible though they are present in the atmosphere, their composition is heightened by activities such as decomposed organic materials and waste from domestic sources as well as industrial activities which increases the threat to human life and environmental quality.

In relation to the above, Metz et al. (2007) stated that when natural parts of municipal solid waste (MSW) breaks down the outflow of some hurtful gases comprising of 50-60% methane, 30-40% carbon dioxide, and 2-9% of different gases are discharged to the environment as overwhelming metals. Oxides of sulfur (SOX) and Nitrogen (NOX) can cause lung and cardiovascular illnesses, while suspended particulate matter has been accounted for to cause asthma, bronchitis, lung malignant growth, cardiovascular ailment, birth deformity and unexpected death (US-EPA, 1999; Rim-Rukeh, 2014).

It is therefore necessary owing to the challenges put forth by inappropriate waste management practices that studies such as this is timely as to protect life and enhance the quality of the environment, hence this study is concerned with examining environmental and health risk implications of air quality in the vicinity of the Port Harcourt airport road dumpsite. The key objectives of the study are to:

1. Determine the air quality in the vicinity of the Port Harcourt airport road dumpsite.
2. Examine the health risk implications of air quality in the study location.
3. Ascertain the environmental implications of the air quality in the vicinity of the Port Harcourt airport road dumpsite.
4. Identify if there are variations in air quality in the different sections in the study location.

The hypothesis which this study tried to verify is stated thus;

H₀₁. There is no statistically significant variation in air quality in the different sections of the study area.

H₀₂. There is no statistically significant impact of air quality on environmental quality.

H₀₃. There is no statistically significant impact of air quality on health of residents the vicinity of the Port Harcourt airport road dumpsite.

MATERIALS AND METHODS

Study area

The city of Port Harcourt is growing due to the high level of industrial activities which have generated high population. It is the capital city of Rivers State. The present day Port Harcourt is made up of four Local Government

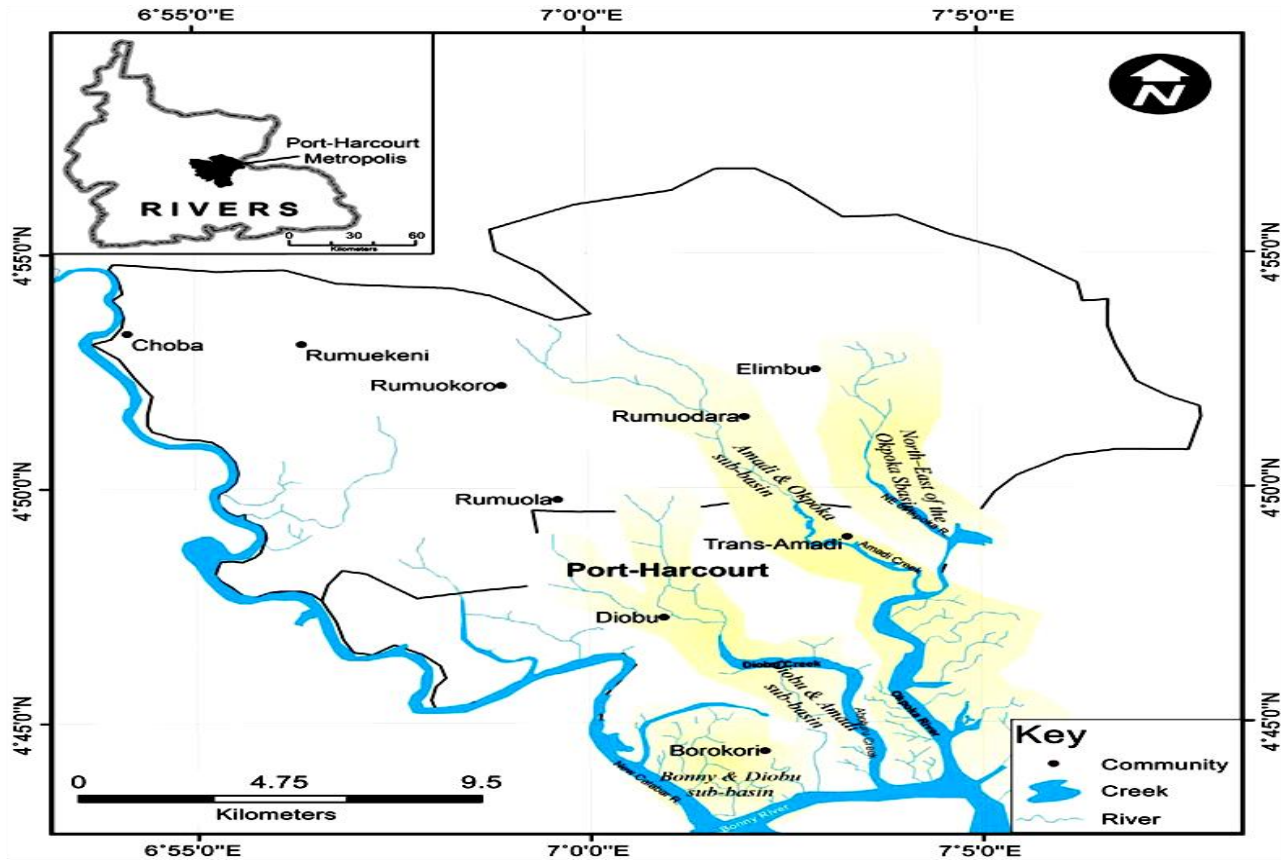


Figure 1. Showing study area.

Areas. The dumpsite is located along the new airport road by Special Anti-Robbery Squad (SARS) road Rumuagholu and boundary with Rukpoku, Aluu and Rumuosi communities all in the present day Obio/Akpor Local Government Area of Rivers State. The area geographically is located between latitude $4^{\circ} 45' 0''$ and $4^{\circ} 55' 0''$ N and longitude $6^{\circ} 55' 0''$ and $7^{\circ} 5' 0''$ E. Its topography is novel and it is situated inside the waterfront fields which by its structure are of the sedimentary rocks of the Agbada, Akata and Benin formation. The climatic condition is the humid tropical atmosphere (Osuiwu and Ologunorisa, 1999) with a normal yearly temperature of 26.5°C . The area experiences about 2476 mm of precipitation falls annually. January is the driest month in terms of precipitation with about 31 mm rain fall. Rainfall is mostly observed in the month of September, with an average of 401 mm. About 370 mm difference exists between the driest month and the wettest. The area has a mean temperature of 24°C , which varies within the year. The area is endowed with abundant sunshine due to its geographical location near the equator. The sun is vertically overhead throughout the year. Day light hours are more because of the long duration of solar radiation. The region is endowed with abundant natural resources such as oil and gas and forest for biodiversity conservation. The surface geology of the area is fairly

stable without human interference such as drilling and oil exploration activities. The vegetation of the study area is the rainforest vegetation. This as shown in the Figure 1.

Methods

This study in line with the objectives adopted the quasi-experimental research design alongside the cross sectional research design. The primary and secondary data sources were used to illicit data for the study. Hence, in order to achieve the set goal for this study the data for this study concentrated more on the primary data sources which includes, field observation, air quality assessment, questionnaire administration and retrieval. Thereafter, secondary sources such as the World Health Organization standard for air quality was sought as well as works of other scholars in the related field.

The population of interest to the researcher owing to the nature of the area are those persons who reside within 1 km radius of the area, this the researcher was able to ascertain through recognizance survey on both sides of the dumpsite which are towards Rumuagholu and Rukpoku Communities. On the both sides, a total of 185 households were identified as the study population, thereafter the study adopted the use of 50% of the



Plate 1. Dräger-X-am5600 and Particle Counters.



Plate 2. Measurement in process.

population which is statistically acceptable, Ezeh (2005) as cited in Ogoloma (2012). This gave the study a sample size of 93.5 approximately 94 households. Therefore, the sample size for the study is 94 households but attention was strictly given to house hold heads as the recipient of the questionnaire, which was administered through simple random sampling for only respondents who reside within 1 km radius of the area. The questionnaire was distributed with the support of field assistants and the recipient which are the household heads were asked to go through the questionnaire and respond adequately, hence they were allowed to keep the copies for a period of three days where after it was retrieved for analysis.

Air quality data was collected using air quality equipments and the parameters of interest to the study include CO_2 , CH_4 , O_2 , CO , $\text{PM}_{2.5}$, Ni, Cr, PM_{10} , Temperature and RH. The equipments includes; hand-held SPM meter (Dräger-X-am5600) and Particle Counter (Plates 1 and 2). The monitor uses light scatter to measure individual particles instead of clouds like other monitors. The particle information is then grouped into size ranges and converted to mass concentration over 4 minutes at a flow rate of 2.83 L/min into measuring ranges of: 1–10 micrograms per cubic metre mass concentration. Measurements were done by holding the sensor to a

height of about two meters in the direction of the prevailing wind and readings recorded at stability. ASTM D1971/4691 was employed for the analysis of trace metals (Ni and Cr) particulates using Shimadzu AA-6650 atomic absorption spectrophotometer. The study was carried out in November, 2019. Air sampling was carried out in three locations, the dumpsite, 250 m and 500 m away from the dumpsite and at intervals of 5 hours each for one day which are 6:30 am, 12:30 and 5:30 pm respectively.

Data analyses

Simple descriptive statistics was used in the analysis of the data, this includes the use of tables and percentages. Thereafter, the study hypotheses were tested using the Analysis of Variance statistical tool (ANOVA) for hypothesis one and the Chi-square statistical tool for hypotheses two and three of the study.

RESULTS

Table 1 shows the air quality in the vicinity of the airport road dumpsite at the morning hours, the record for the

Table 1. Air quality data of the area in the morning hours.

S/N	Parameters	Distance		
		Dumpsite	250 m	500 m
1	Wind Speed (m/s)	1.93 (max)	1.82 (max)	1.50 (max)
		0.60 (min)	0.70 (min)	0.50 (min)
2	Relative Humidity (%)	82.4	73.5	68.4
3	Temperature (°C)	32.07	23.24	30.29
4	CO ₂ (%/vol)	0.05	0.04	0.03
5	CO (ppm)	0.03	0.02	0.02
6	O ₂ (%)	20.9	20.9	20.9
7	PM 2.5	13	15	12
8	PM 10	24	32	27
9	Ni (µgm ⁻³)	0.096	0.091	0.087
10	Cr (µgm ⁻³)	0.228	0.201	0.197

Source: Field report (2019).

Table 2. Air quality of the area in the afternoon Hours.

S/N	Parameters	Distance		
		Dump	250 m	500 m
1	Wind Speed (m/s)	1.43 (max)	1.72 (max)	1.43 (max)
		0.40 (min)	0.80 (min)	0.40 (min)
2	Relative Humidity (%)	72.7	67.5	65.3
3	Temperature (°C)	31.07	30.24	32.76
4	CO ₂ (%/vol)	0.04	0.04	0.03
5	CO (ppm)	0.02	0.02	0.02
6	O ₂ (%)	20.9	20.9	20.9
7	PM 2.5	10	15	13
8	PM 10	27	28	25
9	Ni (µgm ⁻³)	0.091	0.087	0.079
10	Cr (µgm ⁻³)	0.218	0.206	0.201

Source: Field report (2019).

afternoon and evening were captured separately. It was observed that at the dumpsite, the result shows that wind speed on the maximum is 1.93 m/s while on the minimum it is 0.60 m/s, at 250 m away, wind speed is 1.82 m/s on the maximum and 0.70 m/s on the minimum while at 500 m away, wind speed was observed to be 1.50 m/s on the maximum and 0.50 m/s on the minimum. In the case of relative humidity, it was observed that at the dump it was 82.4%, at 250 m away it was observed to be 73.5% while at 500 m away it was observed to be 68.4%. Measurements for temperature showed that at the dump, temperature was 32.07°C, 250 m away it was observed to be 23.24°C while at 500 m distance it was observed to be 30.29°C. Measurements for CO₂ showed that at the dump, CO₂ recorded 0.05 ppm, at 250 m away it was 0.04 ppm while at 500 m away its record was 0.03 ppm. In the same vein, measurements for CO showed that at the dump, it was 0.02 ppm and this was the same in the case of 250 m and that of 500 m away respectively. Measurement for O₂

also showed that at the dump the reading was 2.09% and this is the same for 250 m and 500 m away respectively.

Measurements for PM 2.5 showed that at the dumpsite, PM 2.5 recorded 13 µgm⁻³, at 250 m away, it recorded 15 µgm⁻³ and at of 500 m away, it recorded 12 µgm⁻³. In the case of PM 10, the Table 1 showed that at the dump PM 10 recorded 24 µgm⁻³, at 250 m it recorded 32 µgm⁻³ and at 500 m away it recorded 27 µgm⁻³. Nickel measurements as shown on the Table 1 revealed that at the dumpsite, it had a value of 0.096 µgm⁻³, at 250 m away, it recorded 0.091 µgm⁻³ and at 500 m away, it recorded 0.087 µgm⁻³. Lastly, chromium measurements in the dump showed a value of 0.228 µgm⁻³, at 250 m away, it showed a value of 0.201 µgm⁻³ and at 500 m away, it showed a value of 0.197 µgm⁻³.

The Table 2 expresses the air quality of the vicinity of the airport road dumpsite in the afternoon hours, it is observed that at the dumpsite measurement taken shows that wind speed on the maximum was 1.43 m/s while on the

Table 3. Air quality of the area in the evening hours.

S/N	Parameters	Distance		
		Dumpsite	250 m	500 m
1	Wind Speed (m/s)	1.15 (max) 0.20(min)	1.40 (max) 0.20 (min)	1.0 (max) 0.80 (min)
2	Relative Humidity (%)	79.2	81.8	88.6
3	Temperature (°C)	27.9	27.18	26.73
4	CO ₂ (%/vol)	0.04	0.04	0.04
5	CO (ppm)	0.02	0.02	0.02
6	O ₂ (%)	20.9	20.9	20.9
7	PM 2.5	3	4	5
8	PM 10	17	18	26
9	Ni (µgm ⁻³)	0.095	0.098	0.087
10	Cr (µgm ⁻³)	0.223	0.210	0.192

Source: Field report (2019).

minimum it was 0.40 m/s, at 250 m distance from the dump wind speed was 1.72 m/s on the maximum and 0.80 m/s on the minimum while at a distance of 500 m wind speed was observed to be 1.43 m/s on the maximum and 0.40 m/s on the minimum.

In the case of relative humidity, it is observed to be 72.7% at the dumpsite, at the distance of 250 m, it was observed to be 67.5% while at the distance of 500 m it was observed to be 65.3%. Measurements for temperature showed that at the dump, temperature was 31.07°C, at the distance of 250 m, it was observed to be 30.24°C while at the distance of 500 m it was observed to be 32.76°C.

Measurements for CO₂ showed that at the dump, CO₂ recorded 0.04 ppm, at the distance of 250 m, it was 0.04 ppm while at the distance of 500 m, its record was 0.03 ppm. In the same vein, measurements for CO showed that at the dump, CO was 0.02 ppm and this was the same in the case of the distance of 250 m and that of 500 m respectively. Measurement for O₂ also showed that at the dump the reading was 2.09% and this is the same for 250 and 500 m distance respectively.

Measurements for PM 2.5 showed that at the dump PM 2.5 recorded 10 µgm⁻³, at the distance of 250 m, it recorded 15 µgm⁻³ and at the distance of 500 m, it recorded 13 µgm⁻³. In the case of PM 10, the Table 2 showed that at the dump, PM 10 recorded 27 µgm⁻³, at the distance of 250 m, it recorded 28 µgm⁻³ and at the distance of 500 m, it recorded 25 µgm⁻³. Nickel measurements as shown on the Table 2 revealed that at the dump, a value of 0.091 µgm⁻³ was recorded, at the distance of 250 m, it recorded 0.087 µgm⁻³ and at the distance of 500 m, it recorded 0.079 µgm⁻³. Lastly, chromium measurements in the dump showed a value of 0.218 µgm⁻³, at the distance of 200 m, it showed a value of 0.206 µgm⁻³ and at the distance of 500 m, it showed a value of 0.201 µgm⁻³.

The Table 3 expresses the mean air quality of the vicinity of the airport road dumpsite at the evening hours, it was observed that at the dumpsite, measurement taken shows

that wind speed on the maximum was 1.15 m/s while on the minimum it was 0.20 m/s, at 250 m distance from the dump, wind speed was 1.40 m/s on the maximum and 0.20 m/s on the minimum while at a distance of 500 m wind speed was observed to be 1.0 m/s on the maximum and 0.80 m/s on the minimum. In the case of relative humidity, it was observed at the dumpsite a relative humidity of 79.2%, at the distance of 250 m, it was observed to be 81.8% while at the distance of 500 m, it was observed to be 88.6%. Measurements for temperature showed that at the dump, temperature was 27.9°C, at the distance of 250 m, it was observed to be 27.18°C while at the distance of 500 m, it was observed to be 26.73°C.

Measurements for CO₂ showed that at the dump, CO₂ recorded 0.04 ppm, at the distance of 250 m, it was 0.04 ppm while at the distance of 500 m, its record was 0.04 ppm. In the same vein, measurements for CO showed that at the dump, CO was 0.02 ppm and this was the same in the case of the distance of 250 m and that of 500 m respectively. Measurement for O₂ also showed that at the dump the reading was 2.09% and this is the same for 250 and 500m distance respectively.

Measurements for PM 2.5 showed that at the dump, PM 2.5 recorded 3 µgm⁻³, at the distance of 250 m, it recorded 4 µgm⁻³ and at the distance of 500 m, it recorded 5 µgm⁻³. In the case of PM 10, the Table 3 showed that at the dump, PM 10 recorded 17 µgm⁻³, at the distance of 250 m, it recorded 18 µgm⁻³ and at the distance of 500 m, it recorded 26 µgm⁻³. Nickel measurements as shown in Table 3 revealed that at the dump, a value of 0.095 µgm⁻³ was recorded, at the distance of 250 m, it recorded 0.098 µgm⁻³ and at the distance of 500 m, it recorded 0.087 µgm⁻³. Lastly, chromium measurements in the dump showed a value of 0.223 µgm⁻³, at the distance of 200 m it showed a value of 0.210 µgm⁻³ and at the distance of 500 m it showed a value of 0.192 µgm⁻³.

Table 4 shows the mean air quality data of the dumpsite from the different sampling points. Wind speed measure-

Table 4. Mean air quality data of the area.

S/N	Parameters	Distance		
		Dump	250m	500m
1	Wind Speed (m/s)	1.50 (max)	1.65 (max)	1.31(max)
		0.40 (min)	0.33 (min)	0.56(min)
2	Relative Humidity (%)	78.1	74.2	74.1
3	Temperature (°C)	30.3	26.8	29.9
4	CO ₂ (%/vol)	0.04	0.04	0.03
5	CO (ppm)	0.02	0.02	0.02
6	O ₂ (%)	20.9	20.9	20.9
7	PM 2.5	8.66	11.3	10
8	PM 10	22.7	26	26
9	Ni (µgm ⁻³)	0.094	0.092	0.084
10	Cr (µgm ⁻³)	0.223	0.205	0.198

Source: Field report (2019).

Table 5. Mean air quality of the area and World Organization standard for air quality.

S/N	Parameters	Distance			WHO
		At point	250m	500m	
1	Wind Speed (m/s)	1.50 (max)	1.65 (max)	1.31(max)	NA
		0.40 (min)	0.33 (min)	0.56(min)	
2	Relative Humidity (%)	78.1	74.2	74.1	NA
3	Temperature (°C)	30.3	26.8	29.9	NA
4	CO ₂ (%/vol)	0.04	0.04	0.03	N.A
5	CO (ppm)	0.02	0.02	0.02	^d 9
6	O ₂ (%)	20.9	20.9	20.9	N.A
7	PM 2.5	8.66	11.3	10	^d 25
8	PM 10	22.7	26	26	^d 70
9	Ni (µgm ⁻³)	0.094	0.092	0.084	^f 0.01
10	Cr (µgm ⁻³)	0.223	0.205	0.198	^f 0.02

Source: Field report (2019).

ment reveals that at the dump, the record for wind speed is 1.50 m/s on the maximum and 0.40 m/s on the minimum, at the distance of 250 m, wind speed record was 1.65 m/s on the maximum and 0.33 m/s on the minimum while at the distance of 500 m, the record was 1.31 m/s on the maximum and 0.56 m/s on the minimum. Wind speed was higher at the distance of 250 m away from the dumpsite.

Relative Humidity recorded shows that relative humidity is higher at the dumpsite as it recorded a value of 78.1% which is far more than the value recorded at the distance of 250 m and 500 m which accounts for 74.2% and 74.1% respectively. Temperature report revealed that the dump recorded the highest amongst others with a temperature value of 30.3°C, while at the distance of 250 m had a temperature value of 26.8 and 29.9°C for the distance of 500 m.

CO₂ had a mean value of 0.04 ppm at the dumpsite, same at the distance of 250 m away from the dump and 0.03 at the distance of 500 m away from the dump. In the case of CO in the three identified sampling points, the

same mean value of 0.02 was recorded. For O₂, a mean value of 20.9% was observed in all the sampling points.

Particulate matter observation revealed differently from the above, PM 2.5 at the dumpsite had a mean value of 8.66 µm, 11.3 µm at a distance of 250 m away from the dumpsite and 10 µm at the distance of 500 m away from the dumpsite. PM 10 on the other hand had a mean value of 22.7 µm at dumpsite, 26 µm at a distance of 250 m away from the dumpsite and 26 µm at a distance of 500 m away from the dumpsite.

Ni as shown on the Table 4 had a mean value of 0.094 µgm⁻³ at dumpsite, 0.092 µgm⁻³ at a distance of 250 m away from the dumpsite and 0.084 µgm⁻³ at a distance of 500 m away from the dumpsite. In the case of Cr, it had at the dumpsite a mean value of 0.223µgm⁻³, 0.205µgm⁻³ at a distance of 250 m and 0.198 µgm⁻³ at a distance of 500 m away from the dumpsite.

The Table 5 shows air quality of the airport road dumpsite in relation to World Health organization standard for air quality. From the Table 5, some of the parameters

of interest are not applicable in the WHO enlisted standards. The Table 5 further shows that amongst all the parameters listed only Nickel and Chromium have values more than the set standard in all the three sample locations on an annual basis.

Socio-demographics of respondents

Table 6 shows questionnaire administration and retrieval, as observed, a total of 94 respondents were sampled for the study only 89 of them returned back the questionnaire fully filled and complete which was used for the analysis of the study.

Table 7 shows the socio demographic characteristics of the respondents in the study. A total of 73 male which represents 77.7% of the study population participated in the study as against 21 female which represent 22.3% of the population. Age of respondents as observed was more amongst the age range of 36 to 45 years with a total of 44 respondents which represents 46.8% of the study population; this was followed by the age range of 25 to 35 with a total of 29 respondents which represents 30.9% of the study population and lastly by those in the age range of 45 and above with a total population of 21 respondents which represents 22.3% of the study population.

The occupation of respondents showed that artisans were more with a total population of 35 respondents which represents 37.2% of the study population; this was followed by traders with a total of 32 respondents which represents 34.0% of the study population and civil servants with a population of 27 respondents which represents 28.7% of the study population.

Educational attainment of respondents as observed showed that more of the respondents have attained secondary education, this accounts for 53 respondents which represents 56.4% of the study population; this is followed by primary school attainment with a population of 20 respondents which represents 21.3% of the study population, tertiary education attainment had a total of 19 respondents which represents 20.2% of the study population and lastly those without formal education were 2 respondents which represents 2.12% of the study population.

Environmental implications of the air quality in the vicinity of the Port Harcourt airport road dumpsite

This section of the study reveals the perception of the respondents in relation to their perceived implications of air quality in the vicinity of the Port Harcourt airport road dumpsite. Table 8 shows that on the issue of waste dumpsite in the area influencing air quality which affects human health, 37 respondents which represent 39.4% of the study population strongly agreed, 28 respondents which represents 29.8% of the study population agreed, 16 respondents which represents 17.0% of the study

Table 6. Questionnaire administration and retrieval.

Response	Frequency	Percentage (%)
Number Administered	94	100
Number Collected	89	94.7

Source: Field report (2019).

Table 7. Socio demographic characteristics of the respondents.

Socio demographic characteristics	Respondents
Sex	
Male	73
Female	21
Total	94
Age	
25-35	29
36-45	44
45 and above	21
Total	94
Occupation	
Trading	32
Civil Servant	27
Artisan	35
Total	94
Level of Education	
Primary	20
Secondary	53
Tertiary	19
No formal Education	2
Total	94

Source: Field report (2019).

Table 8. Waste dumpsite in the area influences air quality which affects Human health.

Response	Frequency	Percentage
Strongly Agreed	37	39.4
Agreed	28	29.8
Disagreed	16	17.0
Strongly disagreed	13	13.8
Total	94	100

Source: Field report (2019).

population disagreed while 13 respondents which represents 13.8% of the study population strongly disagreed.

Table 9 shows the ailments associated with waste dump environment, here 27 respondents which represent 28.7%

Table 9. Ailments associated with air quality around waste dump environment.

Response	Frequency	Percentage
URTI	27	28.7
Rashes	32	34.0
Cough/Catarrh	20	21.3
Eye Irritation	17	18.1
Total	94	100

Source: Field report (2019).

Table 10. Air quality influences environmental quality in the waste dump vicinity.

Response	Frequency	Percentage
Strongly Agreed	58	61.7
Agreed	27	28.7
Disagreed	7	7.4
Strongly Disagreed	2	2.2
Total	94	100

Source: Field report (2019).

Table 11. The presence of waste dump in the vicinity is an environmental nuisance.

Response	Frequency	Percentage
Strongly Agreed	27	28.7
Agreed	31	32.9
Disagreed	21	22.3
Strongly Disagreed	15	15.9
Total	94	100

Source: Field report (2019).

of the study population consented to upper respiratory tracts infection, 32 respondents which represents 34.0% of the study population agreed that it is rashes, 20 respondents which represents 21.3% of the study population stated that it is cough/catarrh while 17 respondents which represents 18.1% of the study population consented to eye irritation.

Table 10 shows the perception of the people to air quality as influencing environmental quality in the vicinity of the dump, 58 respondents which represent 61.7% of the study population agreed, 27 respondents which represents 28.7% of the study population agreed, 7 respondents which represents 7.4% of the study population disagreed while 2 respondents which represents 2.2% of the study population strongly disagreed .

Table 11 shows that on the issue of the presence of waste dump in the vicinity is an environmental nuisance, 27 respondents which represent 28.7% of the study population strongly agreed, 31 respondents which represents 32.9% of the study population agreed, 21 respon-

Table 12. The waste dump has deformed the land in the area.

Response	Frequency	Percentage
Strongly Agreed	42	44.7
Agreed	22	23.4
Disagreed	17	18.1
Strongly Disagreed	13	13.8
Total	94	100

Source: Field report (2019).

Table 13: Rental and Property value in the vicinity is influenced by the waste dump.

Response	Frequency	Percentage
Strongly Agreed	32	34.0
Agreed	19	20.2
Disagreed	23	24.5
Strongly Disagreed	20	21.3
Total	94	100

Source: Field report (2019).

dents which represents 22.3% of the study population disagreed while 15 respondents which represents 15.9% of the study population strongly disagreed.

Table 12 shows that on the issue that the waste dump has deformed the land in the area, 42 respondents which represent 44.7% of the study population strongly agreed, 22 respondents which represents 23.4% of the study population agreed, 17 respondents which represents 18.1% of the study population disagreed while 13 respondents which represents 13.8% of the study population strongly disagreed.

Table 13 shows that on the issue of rental and property value in the vicinity is influenced by the waste dump, 32 respondents which represent 34.0% of the study population strongly agreed, 19 respondents which represents 20.2% of the study population agreed, 23 respondents which represents 24.5% of the study population disagreed while 20 respondents which represents 21.3% of the study population strongly disagreed

Table 14 shows that on the issue of the waste dump defacing the aesthetics of the area, 51 respondents which represent 54.3% of the study population strongly agreed, 26 respondents which represents 27.7% of the study population agreed, 13 respondents which represents 13.8% of the study population disagreed while 4 respondents which represents 4.2% of the study population strongly disagreed.

Hypotheses testing

The first study hypothesis (H_{01}) states that there is no statistically significant variation in air quality in the different

Table 14. The presence of the waste dump has defaced the aesthetics of the area.

Response	Frequency	Percentage
Strongly Agreed	51	54.3
Agreed	26	27.7
Disagreed	13	13.8
Strongly disagreed	4	4.2
Total	94	100

Source: Field report (2019).

Table 15. Result of ANOVA for variation in air quality in the different sections of the Area.

Source of variation	SS	Df	MS	F	P-value	F crit
Between Groups	0.134438	2	0.067219	0.000127	0.999873	3.31583
Within Groups	15910.15	30	530.3384			
Total	15910.29	32				

Table 16. Chi-Square analysis table for impact of air quality on environmental quality

Response	Observed	Expected	O-E	O-E ²	O-E ² /E
Strongly Agreed	58	18.8	39.2	1536.6	81.7
Agreed	27	18.8	8.2	67.2	3.57
Disagreed	7	18.8	-11.8	139.2	7.4
Strongly Disagreed	2	18.8	-16.8	282.2	15.0
χ^2					107.67

Table 17. Chi-Square analysis table for impact of air quality on health

Response	Observed	Expected	O-E	O-E ²	O-E ² /E
Strongly Agreed	27	18.8	8.2	67.2	3.57
Agreed	32	18.8	13.2	174.2	9.26
Disagreed	20	18.8	1.2	1.44	0.07
Strongly Disagreed	17	18.8	-1.8	3.24	0.18
χ^2					13.08

sections of the study area. The ANOVA Table 17 reveals that calculated F statistic value for the analysis is 0.000127 while the critical value is 3.31583. Therefore, since the calculated F statistic value of 0.000127 is less than the critical value of 3.31583 at F^2_{32} degree of freedom, the null hypothesis H_0 of no significant variation is accepted and the alternate hypothesis H_1 is rejected. The result of the study revealed that there is no statistically significant variation in air quality in the different sections of the study area.

The second study hypothesis (H_{02}) states that there is no statistically significant impact of air quality on environmental quality; this was tested with the aid of the Chi-Square statistical tool: $df = (R-1) (C-1) = (4-1) (1-1) = 3$. Since the critical Chi square value at 95% significant

level against 3 degrees of freedom gives the value of 7.81, the calculated Chi square value of 107.67 is greater than the critical Chi square value of 9.49; therefore, the null hypothesis of no significant impact was rejected and the alternate hypothesis which states that there is a statistically significant impact of air quality on environmental quality was accepted.

The third study hypothesis (H_{03}) states that there is no statistically significant impact of air quality on health of residents at the vicinity of the Port Harcourt airport road dumpsite: $df = (R-1) (C-1) = (4-1) (1-1) = 3$. Since the critical Chi square value at 95% significant level against 4 degrees of freedom gives the value of 7.81. The calculated Chi square value of 13.08 is greater than the critical Chi square value of 7.81; therefore, the null hypothesis of no

significant impact was rejected and the alternate hypothesis which states that there is a statistically significant impact of air quality on Health was accepted.

DISCUSSION

This study was carried out to examine environmental and health risk implications of air quality in the vicinity of the Port Harcourt airport road dumpsite. In order to achieve the aim of the study, some objectives as well as research questions were raised which the present study provided explanations for. Therefore, this discussion is made in the light of the study objectives.

The first objective of this study was to determine the air quality in the vicinity of the Port Harcourt airport road dumpsite, this was done with the aid of some equipment, which measured the different air quality parameters highlighted as reported in Table 1 of the study. It was discovered that amidst all the parameters measured in the different sampling locations, Nickel and chromium were higher than the acceptable limits while other parameters were within.

This however revealed that the air in the vicinity of the waste dump was polluted owing to the fact that the parameters of concern were not all within the acceptable World Health Organization Standard for air quality, hence is termed polluted. The effect of breathing this polluted air, on regular basis for a long time has exposed the residents within the study area to different detrimental health challenges. The findings of this research are in tandem with previous researches by the likes of Chukwu-Okeah et al. (2019), Igboji and Joseph (2015), Vincent and Obisesan (2014) and Agwu and Ozeh (2013).

The second study objective was to examine the health risk implications of air quality in the study location. Response from the questionnaire analyzed as shown on Table 8 revealed that waste dumpsite in the area influences air quality, this was agreed to by an overwhelming 69.2% of the respondents. This finding is also in line with Ezekwe and Arukoyu (2017), Ubouh et al. (2016), Allen et al. (2015) and Committee on Environmental Health (2004).

In Table 9, ailments arising from the presence of the dumpsite as revealed have upper respiratory tract infection (URTI) and rashes topping the list with a whopping 62.7% response rate from respondents. This however provides an evidence of the health implications of the waste dumpsite. This is also in line with the works of Ochindo (2015), Brauer et al. (2008) and Bell et al. (2004).

The third objective however was to ascertain the environmental implications of air quality in the vicinity of the Port Harcourt airport road dumpsite. Response from the questionnaire analysed as showed in Table 10 revealed that a total 90.4% of the respondents agreed that air quality in the vicinity of the waste dump influences environmental quality of the area. In Table 11 also, 61.6%

of respondents agreed that the presence of waste dump in the vicinity is an environmental nuisance, this is in agreement with the work of Ezekwe and Arukoyu (2017), Pieters et al. (2015), Mateen and Brook (2011), Miller et al. (2007) and Hamoda (2004). In line with the above, the study further showed in Tables 12, 13 and 14 that 68.1% of the respondents agreed that the dump have deformed the land in the area, 54.2% of the respondents agreed that the location of the dump have affected property and rental value in the vicinity and 81.9% of the respondents agreed the dump has defaced the aesthetics of the area.

In the light of objective four, this was to identify if there are variations in air quality in the different sections of the study location. From the tested hypothesis in Table 17, the study shown that there is no statistically significant variation in air quality in the different sections of the study area. This also agrees with the work of Ochindo (2015), Amuda et al. (2014) and Saber and Heydari (2012).

Conclusively, the study hypothesis tested confirmed that there are impacts arising from the waste dumpsite on health and environment which however explains that there are environmental and health implications in the vicinity of the Port Harcourt airport road dumpsite. However, the findings of the study include:

1. Nickel and Chromium amongst other parameters measure were above the WHO set limit, hence the air was termed polluted.
2. URTI and rashes are prominent ailments that are prevalent in the area.
3. There is an evidence of the health implications of the waste dump on residents.
4. Air quality influences environmental quality in the waste dump vicinity and that the presence of waste dumpsite in the vicinity is an environmental nuisance.
5. There is no statistically significant variation in air quality in the different sections of the study area.
6. There are impacts arising from the waste dumpsite on health and on the environment, which, however, explains that there are environmental and health implications in the vicinity of the Port Harcourt airport road dumpsite.

Conclusion and recommendations

From the results, it is clear that the citing of the waste dumpsite in the study location was a wrong idea having in mind that the area is developing residential area. This however explains the neglect of urban planning policies and regulations in the city of Port Harcourt. The findings have shown the state of the environment and health of residents around the vicinity of a typical municipal solid waste dumpsite. Therefore, this research recommends that:

1. Proper urban planning should be done, especially, in citing of new dumpsites. The process should include

integrated development plan of appropriate land use, environmental impact assessments and adopting standard regulatory processes.

2. Government should be advised that where waste dumps are cited, residential apartments should not be located within 3 km radius of the dumpsite.
3. In view of the health challenges and other environmental impacts observed around the vicinity of the Port Harcourt airport road dumpsite, the dumpsite should be closed, in order to forestall further deterioration of the health of the resident community and other environmental damages.
4. Since this research was conducted in one dumpsite, further research efforts should be conducted with the aim of evaluating the impacts of all the dumpsites within Port Harcourt City, on the environment and the health of the proximate communities.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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