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Research Article

Comparative assessment of air quality in *Epe,* and *Olusosun* dumpsites of Nigeria

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Abstract: *A comparative assessment of air quality in Epe and Olusosun dumpsites was carried out with a view to understanding if the historical background of dumpsites had an influence on their perceived impacts on the environment as well as their emission concentrates. Primary data was collected through questionnaire administration and the use of portable emission monitoring instruments. A total of 120 copies of self-designed interview questions were administered for the study but 116 were retrieved from both dumpsites and considered valid for the analysis. On the other hand, data collection with a portable air quality monitor was carried out during the month of October 2022. Sampling was done between 10 am and 1 pm. A 60-minute exposure time was observed with each of the instruments (AEROQUAL 500 Series) to measure Carbon dioxide (CO_2), Methane (CH_4), Oxides of nitrogen (NO_x), Sulfur dioxide (SO_2) and Carbon monoxide (CO) and sizes of suspended particulate matter ($PM_{2.5}$ and $PM_{10.0}$) were measured using handheld particulate matter monitoring equipment (AEROCET 531S by Met One Instruments). Within this time belt, the readings were taken three (3) times and averaged to get a value for the time belt using descriptive statistics. The result indicated high concentrations of CO_2, CH_4 and PM during the early hours of the day and gradually decreased as the day went by at both dumpsites. The concentration of SO_2 was higher at Olusosun dumpsite on day 5 when temperature and relative humidity were high from 12 noon. NO_x was detected at both dumpsites at a minimal concentration. In conclusion, higher concentration levels recorded in all analysed gas samples collected from the Olusosun upland dumpsite suggested that the only historical component that could have influenced the dumpsite was "the age of dumpsite" since it is way older than the Epe wetland dumpsite. The topographical nature of the dumpsites (upland and wetland) appears not to have an impact on the air quality values measured. The perception of residents in both dumpsites showed that they were concerned about living and carrying out daily operations in and around the dumpsites.*

Keywords: Air quality, Climate change, Dumpsite, Landfill, Municipal waste, Pollution
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1. Introduction

Air quality assessment; a process of evaluating the integrity of air within a given environment is a mechanism which aids the efficient use of air resources in the following ways: identification, prediction, and evaluation of critical variables, to identify the potential changes in air quality as a result of emissions from potential sources of pollutants like landfill sites (Air Pollution Impact Assessment, 2015).

According to Vincent & Obisesan (2014) and Rim-Rukeh (2014), landfilling is the most common and environmentally safe method of disposing of municipal solid wastes that cannot be reduced, recycled, composted, combusted, or processed. However, landfills threaten the environment through toxic pollutants emitted into the air which are mostly a result of the biodegradation of organic materials in them. Several researchers have examined the concentrations of pollutants and their effect on the environment. Waste Management International (2015) conducted an investigation to study the effect of Kettle man waste disposal facilities on the air quality in California, United States of America. The investigation revealed that the waste facility had no impact on the air quality within the vicinity of the community. In 2015, Njoku studied the effect of waste dumpsites on the quality of air in Abakaliki, Nigeria. The study revealed that the dumpsite considered has not really impacted negatively on the air quality in Abakaliki. In 2007, Elaigwu *et al.* studied the impact of municipal waste dumps on the surrounding air quality in Zaria and Kaduna, Nigeria. The study revealed that the constant burning of dumpsites could contribute significantly to the concentration of heavy metals in the environment. Rim-Rukeh in 2014 assessed the contribution of municipal solid waste dumpsite fire to atmospheric pollution using five dumpsites in the Niger Delta area of Nigeria. The assessment showed that the dumpsite fire in the study areas could threaten the health of anyone especially the dumpsites workers who are regularly exposed to the thick smoke. According to the World Health Organisation, (WHO) (2018) and the World Bank (2022), air pollution is the contamination of the air we breathe, indoors or outdoors, by any chemical or biological agent that modifies the natural characteristics of the atmosphere is an important determinant of health and wellness.

Ahove et al. (2020) and several other scholars have carried out an air quality assessment within the vicinity of the Olusosun dumpsite (which is reported to be the largest dumpsite in West Africa) in Lagos Nigeria, however, it is evident from the previous works that the effect of dumpsite on air quality within the vicinity of the *Epe* dumpsite has not been carried out.

The *Epe* dumpsite is situated on a wetland that supports a diverse population of reptiles, amphibians, birds, and mammals which greatly added to the biodiversity of the area before it was converted to a dumpsite. It is a well-known fact that wetlands act as the kidneys of every landscape, helping to keep the overall ecosystem healthy by cleaning water and removing pollutants. As these wetlands are lost so also are their functions. The *Epe* dumpsite location was originally intended for the construction of an integrated waste management facility which was designed to comprise a material recovery facility (MRF) for retrieval of recyclable materials like bottles, plastics, and others; a compost plant to capture and manage the organic fractions in the waste stream and a sanitary landfill to receive the residual fractions not already recovered upline. The site was on different occasions recognized for different concerns, including its location on the wetland, proximity to proposed airports and others.

Similarly, the Olusosun dumpsite is upland and the most active of all the dumpsites in Lagos state. It happens to be the oldest dumpsite and located right at the Centre of Lagos Metropolis. Olusosun dumpsite was identified and used by the Nigerian Military in the 1960's and 70's as a shooting range for condemned Armed Robbers and coup plotters alike. The site was later excavated and turned into a soil mining area to provide filling materials for roads and the foundation of new building development. The Olusosun site was traversed by a large, burrowed pit which resulted from the long-time uncontrolled excavation and mining by most developers from all parts of Lagos Metropolis. This site was later identified and selected by the Lagos State Waste Management Agency (LAWMA) for a dumpsite and the dumping of waste as well as scavenging of recoverable materials has been on-going since 1992. The dumpsite was further recognized by the World Bank as a dumpsite that attracts desirable attention for upgrading under the World Bank- Assisted program, Lagos Metropolitan Development and Governance Project (LMDGP). Also, the dumpsite benefitted from upgrading and capturing the Landfill gas under the design, build and operate (DBO) arrangement as part of the Lagos State Solid Waste Management Plan.

Landfills and Dumpsites in the world remain a source of environmental and public health concern. This is due to their adverse implication for public health, air quality, surface and ground water quality, global warming and climate change. Landfill gases generated from dumpsites pose a significant threat to the environment and human health. From the perspective of the environment, landfill gases are sources of air quality degradation with characteristic unpleasant odour from hydrogen sulphide and other gases. The gases particularly methane and carbon-dioxide which are greenhouse gases (GHG) are also a source of global warming. Landfill gases are known to be inhibitors of vegetation growth, as well as being source of explosion (methane) and asphyxiation (carbon-dioxide) hazard in confined spaces (Ankeny and Stromberg, and Lee & Jones- Lee 1993, Agency for Toxic Substances and Disease Registry (ATSDR, 2000). In view of the aforementioned issues, a good understanding of the air quality within and around the LAWMA *Epe* and *Olusosun* dumpsites is required. Reliable data and information on the air quality of the dumpsite would not only aid the qualification of the interaction of the dumpsite with the air quality but will also assist in improving the health condition of the residents as well as mitigate the impact of the dumpsite on our environment.

The aim and objective of this work are to assess the effect of *Epe and Olusosun* dumpsites on the air quality within the vicinities with a view to establishing any relationship that may exist based on their histories. This will be done by providing real-time data on the basic air quality level of both dumpsites. Specific objectives include: estimating the concentrations of Carbon dioxide, Methane, Nitrous oxides, Sulfur dioxide and Carbon monoxide within *Epe and Olusosun* dumpsites; determining the perception of the inhabitants to the odor and methane emanating from the dumpsites; determining the historical background of *Epe* Wetland and *Olusosun* Upland Dumpsites pre waste deposition and how it affects the concentration of the pollutants.

2. Materials and Methods

2.1. Description of the study areas

The *Olusosun* upland dumpsite is situated between Latitude 6.5928N and 6’35’34.08936’’ and Longitude 3.38188E and 3^{o}22’54.78204’’ (Figure 1). Olusosun dumpsite is in the Onigbongbo Local Government area of Lagos State It is the most active of all the dumpsites in the Lagos area and has received about 50% of the total waste in the Lagos area since 1992. It is the second largest dumpsite by size, covers a land area of about 42.7 hectares and has a residual life span of 5 years. It receives over 6000 tons of solid waste daily (Figure 2). The depth of the hand-dug well in the region varies from 3.81 m to 30.37 m above the mean sea level. Most of the hand-dug wells were neither lined nor had properly constructed base or covers. The Geology of the area is generally characterized by coastal plain sands which form the low-lying gentle sloping upland and coastal deposits forming extensive red earths, and loose poorly sorted sands that are mixed with the abundance of clay. The dumpsite is also a non-engineered landfill and is surrounded by residential houses, industries, gasoline stations, motor parks and automobile repair workshops.

The *Epe* dumpsite is situated in the Epe Local Government Area of Lagos State, Nigeria which lies between Latitude 6^{0}33'30" and 6^{0}35'00N and Longitude 3^{0}55'30" and 3^{0}56'30"E on the northern flank of the Coastal Lagos Lagoon (Figure 1). It is underlain by the coastal plain sand (CPS) of the Dahomey Basin. *Epe* Wetland dumpsite was opened on the 12th of February 2009. It is the largest landfill by size and covers an area of about 80 hectares. The location is about 5 km on the outskirt of Epe town, along Ibeju/Lekki Epe express way and about 1km from the Epe Lagoon (Figure 3). Behind the dumpsite is the Afero community and opposite it is the Alaro City. A geotechnical study undertaken in the *Epe* dumpsite in 2012 showed that the clearance between the groundwater and the sandy soil averaged 3 m in most areas. The wastes are dumped in both sites without separation. The waste streams ranges from domestic, industrial, organic, commercial and construction waste. The sites undergo rehabilitation annually.

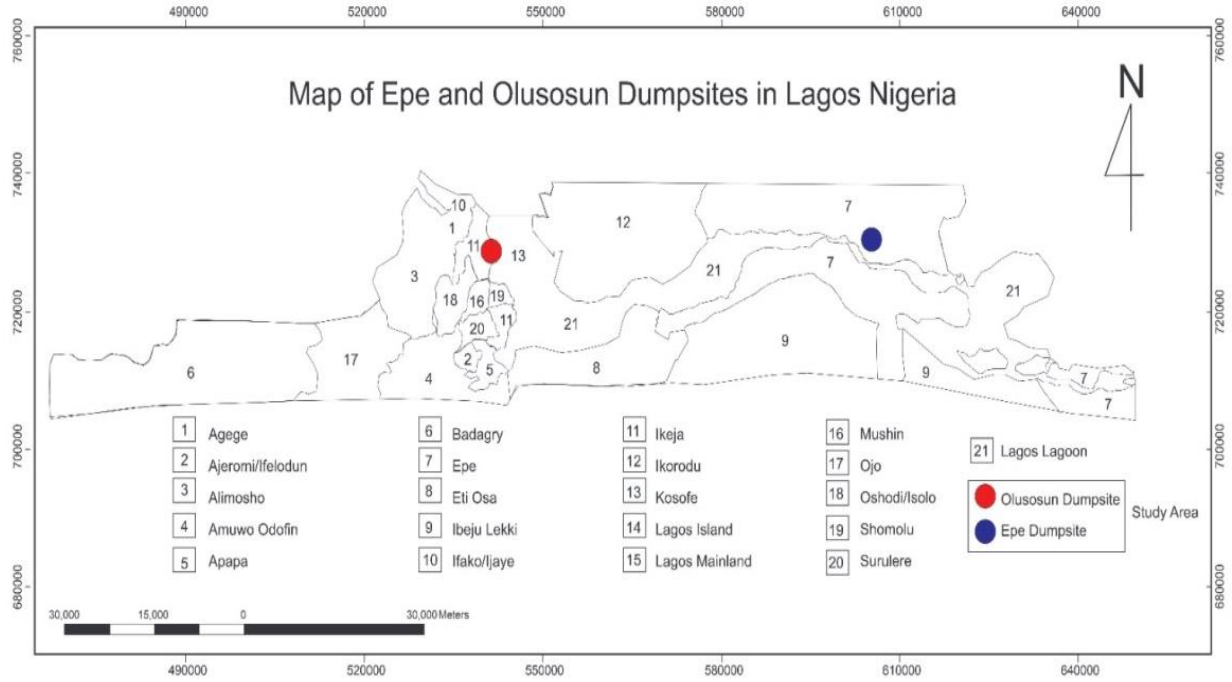

Figure 1: Geological Map of the study areas in Lagos State, Nigeria

Figure 2: Aerial view of Olusosun dumpsite

Figure 3: Aerial view of Epe dumpsite

2.2. Research design

A descriptive survey research design was adopted for this study in two phases. The first phase involved the collection of air quality data which allowed the researcher to determine the amount of pollutant in the selected areas. This phase deployed the use of AEROQUAL 500 series portable air monitoring equipment in detecting the amount of GHGs present within the selected locations in the communities and dumpsites, the gases detected by the device at different time intervals at the locations were noted as well as the temperature and relative humidity. For the second phase, a self- developed assessment interview to assess the perception of individuals (residents, dumpsite staff, truck drivers, waste pickers and vendors in communities around *Epe and Olusosun* neighbourhood) on odour and methane emanating from the dumpsite was done. The interview schedule had a total of 30 items and 4 sections.

2.3. Sampling procedure

The selection of the sampling points was influenced by the number of people who complained about the odour (a minimum of 30) to the team of researchers on arrival at their axis, the group so selected by this method must be at least within 100 metres distance from one sampling point to another, availability of respondents and their willingness to be part of the study. A combination of sampling techniques was employed for this study. For the interview phase, purposive and convenient sampling methods were used to select eligible respondents. This involved the selection of participants based on the scavengers available. The study area was first divided into a number of scavengers on sites and communities were selected at intervals. Purposive sampling was used to select participants based on their suitability to respond and convenience sampling was used based on their availability and willingness to participate. For the air quality monitoring assessment, four sampling points were chosen in each of *Epe and Olusosun* dumpsites. The selection of the sampling point was based on the assessment to human movement as well as wind direction.

2.4. Data collection and analysis

The procedure for data collection in this study was in two major dimensions, the first was for primary data with interview questions and the second was for primary data using a portable emission monitoring instrument. The interview question was distributed across the selected dumpsites in the selected area using a one-on-one administration to the respondents which ensured that detailed information was recorded by the researcher. Data collection with the portable air quality monitor was carried out during the month of October 2022 during the end of the early rains and at the onset of later rains for the year to allow for reliable output. It was done between 10 am and 1 pm. A 60-minute exposure time was observed with each of the instruments to measure the CO, CO_2, CH_4, NO_2 and SO_2, Also, two (2) different sizes of suspended

particulate matter; 2.5 and 10.0 were measured using handheld particulate matter monitoring equipment (AEROCET 531S by Met One Instruments). Within this time belt, the reading was taken three (3) times and averaged using descriptive statistics to get a figure for the time belt. The quantitative data collected was analysed using the IBM-Statistical Package for Social Sciences (SPSS version 24.0; IBM Corp Armonk New York). Descriptive statistics such as percentage, mean and standard deviation were used to organize and describe the variables collected. The results of the air quality monitoring were compared with the relevant Nigeria Ambient Air Quality Standards (NAAQS) of the Federal Ministry of Environment and the air quality standards of the World Bank.

3. Results and Discussion

3.1. Gaseous pollutants and their concentrations

As indicated in Table 1, CO_2, CH_4, and NO_x, were the major GHGs detected in both dumpsites and areas around the dumpsites. H_2S was also detected while CO and SO_2 were not detected contrary to expectations. This may be due to the detection capacities of the instrument, which are 0-100 ppm for SO_2 and 0-25ppm for CO.

However, the non-detection of CO and SO_2 throughout the duration of air quality investigation and sampling in Epe and Olusosun dumpsites are startling, knowing that these gases have been consistently reported in previous studies carried out in dumpsites across the country (Rim-Rukeh, 2014; Musa et al., 2021; Ogbemudia et al., 2020). The absence of CO which is most times associated with fire incidences and incomplete combustion materials in dumpsites (Rim-Rukeh, 2014) may be explained by the fact that no fire incidences were visibly occurring on both study sites throughout the duration of this study.

Higher concentrations of CO_2 were recorded in the early hours of days in Epe, which was ranged from 768.5 ppm to 810 ppm while lower in the afternoon ranged from 789.6 ppm to 795 ppm. Contrarily, in Olusosun, a lower concentration of CO_2 was recorded during the morning hours ranging from 790 ppm to 885 ppm while a range of 799.8 ppm to 1094 ppm was recorded in the afternoon. The highest concentrations of CO_2 at Olusosun were mostly recorded on the 5th day (Saturday), where there was a massive dumpsite activity. Double concentration of CO_2 was also reported around a Solid Waste Dumps in Makurdi (Musa et al. 2021) and around Niger Delta region in Nigeria (Rim-Rukeh, 2014). A high concentration of this gas is expected, due to the biological decomposition of huge volume of organic waste deposited in these sites.

The mean concentration for CH_4 gas recorded in both dumpsites also showed high concentration values ranging from 0 to 24 ppm in the vicinity of the Epe dumpsite, with an increase to as much as 146 ppm recorded at the Olusosun dumpsite (Table 1). Though these values are well below the 1000 ppm standard permissible limit, they are well above the average of 1.14 to 12.17 ppm which was referred as high in the work of Musa et al (2021). Methane being a Greenhouse gas (GHG) with high global warming potential is also a product of the biological breakdown of organic waste components in the absence of oxygen in dumpsites. Compared to the concentration in the Epe dumpsite, higher values recorded in the Olusosun might be a result of thicker piles of waste and oxygen deprivation resulting from these piles in the Olusosun, since this site receives more organic waste than the Epe dumpsite.

Studies showed a concentration of Nitrous oxides (NOx) to be below the standard permissible limit of 0.04 – 0.06 ppm. Similar ranges (0.0 to 0.017 ppm - Epe dumpsite and 0.003 ppm to 0.017 ppm - Olusosun dumpsite) were recorded, showing no significant difference. Higher NO_2 concentrations between 21.0 ppm and 27.3 ppm were recorded in a study carried out by Rim-Rukeh (2014) across five municipal solid waste dump sites where fire the occurrence of incidence is frequent and regular.

Table 1: Concentration of Gaseous Pollutants in Epe and Olusosun Dumpsites

	CO_2 (ppm)						CH_4 (ppm)						NO_X (ppm)					
Time	**EPE 1**			**OLUSOSUN 1**			**EPE 2**			**OLUSOSUN 2**			**EPE 3**			**OLUSOSUN 3**		
10:00	800.00	0.00	839	809	912	780	24.00	0.00	1	10	121	2	0.013	0.008	0.016	0.007	0.015	0.016
10.20	817.00	778	814	814	851	814	19.00	0.00	0	4	92	6	0.011	0.008	0.017	0.017	0.004	0.004
10.40	807.00	765	790	790	922	787	17.00	0.00	0	4	146	5	0.000	0.016	0.017	0.006	0.015	0.004
11:00	795.00	758	797	804	856	778	13.00	0.00	0	1	111	1	0.006	0.016	0.017	0.018	0.015	0.016
12:00	795.00	778	795	787	1557	848	4.00	2.00	4	1	47	1	0.017	0.007	0.017	0.01	0.015	0.016
12.20	782.00	768	804	824	1015	809	3.00	2.00	6	6	51	1	0.008	0.017	0.016	0.017	0.016	0.006
12.40	800.00	763	790	763	892	760	2.00	2.00	2	1	46	1	0.007	0.017	0.017	0.016	0.016	0.005
1:00	804.00	765	790	826	910	782	2.00	2.00	0	6	40	0	0.017	0.016	0.017	0.016	0.003	0.017
AVR	800.00	671.88	802.38	802.13	989.38	795	10.50	1.00	1.63	4.13	81.75	2.13	0.01	0.01	0.02	0.01	0.01	0.01
	$PM_{2.5}$ (ppm)						PM_{10} (ppm)						H_2S (ppm)					
Time	**EPE 4**			**OLUSOSUN 4**			**EPE 5**			**OLUSOSUN 5**			**EPE 6**			**OLUSOSUN 6**		
10:00	4.2	3.1	9.1	7.9	3	2.2	13.6	15.6	13.2	71	8.3	5	0.00	0.00	0	0	0.08	0
10.20	3.6	3.1	3.3	9.1	3.9	2.6	12.2	13.4	11	44.5	12.9	6.2	0.00	0.00	0	0	0.04	0
10.40	4.1	2.5	7.2	9	2.9	3.2	15.1	13.3	17	56.2	11.6	7.3	0.03	0.00	0	0	0.02	0
11:00	3.9	1.8	4.6	9.1	5.1	2.5	7.9	8.5	12.8	44.7	14.1	7.4	0.00	0.00	0	0	0.03	0.01
12:00	5.1	3.2	13.5	8.3	3.1	4.2	13.9	14.9	44.8	46.3	10.1	15.2	0.00	0.00	0	0.02	0.17	0
12.20	6.9	2.5	19.5	13.7	3.3	2.5	7.3	8.6	42.6	155.3	7.4	7.9	0.01	0.03	0.07	0.05	0.05	0
12.40	4.4	1.8	4.7	7.3	5.5	7	9.2	10.1	19.9	45.1	12.1	24.3	0.01	0.00	0	0.12	0.01	0.05
1:00	7.4	2.6	7.6	16.5	7.9	9.6	13.5	14.4	24.1	47.7	18.1	36.5	0.02	0.02	0	0.02	0.04	0.04
AVR	4.95	2.58	8.69	10.11	4.34	4.23	11.59	12.35	23.18	63.85	11.83	13.73	0.01	0.01	0.01	0.03	0.06	0.01

AVR = Average; PM = Particulate Matter, ppm = Parts Per Million

3.2. Percentage distribution of the respondents' demographic characteristics and their perception to dumpsite emission

Table 2 shows the demographical characteristics of respondents in both dumpsites. A greater majority of the respondents from the Epe dumpsites were male while almost equal gender of respondents was seen in Olusosun dumpsite. This gender representative eliminates any form of bias. A look at the age of respondents indicates that majority of the respondents were less than 39 years, an implication that they were more on the youthful side. More respondents were also concerned about the living environment close to the dumpsites in both locations.

Table 2: Demographic characteristics the respondents

Variable	Options	Epe Dumpsite (%)	Olusosun Dumpsite (%)
Sex	Male	79.7	56.0
	Female	20.3	44.0
	Total	100.0	100.0
Age	18 – 28	15.3	10.5
	29 – 39	38.9	43.9
	40 – 49	27.1	22.8
	50 – 59	10.2	19.3
	60 & above	8.5	3.5
	Total	100.0	100.0
Concern about living close to the dumpsites	Yes	54.2	68.4
	No	45.8	31.6
	Total	100.0	100.0

Out of the 116 participants from both Epe and Olusosun dumpsites, a greater percentage responded in the affirmative to perceiving odour from the dumpsites (Table 3). The outcome of this result is similar to the findings of Sakawi, Mastura, Jaafar and Mamud (2011) where 94.7% of the total participants (190) from the neighbouring communities confirmed that they could perceive the odour emanating from the Pajam and Ampar Tenang Landfill sites in Malaysia. How frequently the respondents perceived the odour was the next item. The results indicate that the time of the day or season of the year did not play any role in when they perceived the odour. This peculiar stench has a strong impact on the environment, people living on the dumpsite as well as those living in the neighbouring communities create an uncomfortable environment, harbouring diseases causing vectors such as rodents and flies (Aderemi & Otitoloju, 2012) a common fingerprint of the African dumpsites. An interesting result obtained from the respondents at both dumpsites was that 74 of 116 said they were not bothered about living close to the dumpsites while 42 shared a contrary perception. However, it is worth noting that the majority of the respondents that claim not to be bothered about living close to the dumpsites are the Scavengers working on the dumpsites. Another item which was to assess the respondents' perception of ground water contamination requires a Yes or a No answer. The result showed that a greater percentage of the respondents from both dumpsites believe that their ground water is contaminated as a result of the location of the dumpsites in their communities. The final item assessed the perception of the respondents on the effect of the dumpsites on their health. The greater percentages of respondents in Olusosun dumpsite believed that the dumpsite has a significant impact on their health when compared to responses from Epe dumpsite.

Table 3: Awareness and Perception of respondents to Epe and Olusosun Dumpsites

Variables	Epe dumpsite (%)		Olusosun dumpsite	
Are you satisfied with the location of the dumpsite in your community?	Yes	74	Yes	39
	No	26	No	61
Are you bothered about living close to the dumpsite?	Yes	53	Yes	73
	No	47	No	27
Do you perceive odour emanating from the dumpsite?	Yes	95	Yes	92
	No	5	No	8
What time do you perceive the odour?	Every time	42	Every time	58
	Rainy season	58	Raining season	42
How strong is the odour from the dumpsite?	Mild	7	Mild	7
	Strong	40	Strong	14
	Very strong	53	Very strong	72
	No odour	0	No odour	7
Do you think anything can be done to reduce the odour?	Yes	54	Yes	73
	No	46	No	27
Do you think your ground water is contaminated?	Yes	88	Yes	88
	No	12	No	12
Does the dumpsite affect your health?	Yes	53	Yes	68
	No	47	No	32

3.3. Historical background of the dumpsites

A greater percentage of people in both dumpsites (Table 4) have lived there for a period less than ten years. About 37.3% of the respondents in Epe dumpsite lived there above ten years, which was established about fourteen years ago. Although the site is relatively new, the respondents had enough knowledge on the questions that followed. On the other hand about 43.9% and 31.6% of the respondents at Olusosun dumpsite lived for over 10 and 20 years, respectively.

A greater percentage of respondents in Olusosun responded that the dumpsite was used for mining purpose before the establishment of the dumpsite Epe dumpsite was used for farming. These two activities economical activities are notable sources of livelihood for the inhabitants which have been cut off due to the establishment of the dumpsites. A greater percentage (68.4%) of respondents in Olusosun perceived that these values of the site have been lost since the dumpsite's inception (Table 4). This collaborates with their response in the Table 4 where they recorded "mining" as a major activity that was taking place at the location before the dumpsite. However, in Epe dumpsite which is relatively younger about 22% of the respondents perceived lost value, which implies that the major activity "farming" is not entirely lost. According to the respondents, there is still room to practice farming activities in and around the Epe dumpsite. As indicated in Table 4, values at the Epe site have not been lost since the inception of the dumpsite. However, the same cannot be said for the Olusosun dumpsite. Not surprisingly, a greater percentage of respondents in both dumpsites indicated that no value has been gained since the inception of the dumpsites instead perceived health impacts on people living close to the dumpsites were recorded mostly as fever, cough and catarrh, eye irritation, sore throat, restlessness and breathing difficulty.

Table 4: Respondents' historical knowledge and perceived impacts of dumpsite location

Variables	Options	Epe Dumpsite (%)	Olusosun Dumpsite (%)
How long do you lived in the dumpsite?	< 10 years	62.7	56.1
	10-20 years	22.0	12.3
	21-30 years	3.4	22.8
	31-40 years	5.1	3.5
	41-50 years	3.4	1.8
	Above 50 yrs	3.4	3.5
	Total	100.0	100.0
For what purpose this location used for before it became a dumpsite?	Shooting range	14.0	0.0
	Mining	49.2	25.5
	Farming	0.0	57.6
	No idea	36.8	16.9
	Total	100	100
Has there been a loss of value for this location since it became a dumpsite	Yes	68.4	22.0
	No	31.6	78.0
	Total	100	100
If yes, please mention values that have been lost since dumpsite	Aesthetic	1.8	1.7
	Property	8.8	6.8
	Farmland	17.5	10.1
	Electricity	1.8	0.0
	None	70.1	81.4
	Total	100	100
What natural resources has been lost since inception of the dumpsite	Soil/land	7	16.9
	Water & air	22.8	37.4
	Vegetation	0.0	16.9
	Life	7	0.0
	None	63.2	28.8
	Total	100	100
What natural resources has been gained since inception	Fertilizer	12.3	10.2
	Recyclables	3.5	0.0
	None	84.2	89.8
	Total	100	100
What common illness are frequently noticed by you or your friends since inception	Fever, cough and catarrh, eye irritation, sore throat, restlessness, breathing difficulty	17.5	16.9
	Fever, restlessness, cough & catarrh	26.3	25.4
	Breathing difficulty & restlessness	28.1	10.2
	Cough & catarrh	12.3	18.7
	Fever	15.8	28.8
	Total	100	100

4. Conclusion

The study concludes that apart from CO and SO_2 which were not detected throughout the duration of sampling in both study sites. CO_2, CH_4, NO_X, and H_2S all occurred at different concentration levels showing some form of air pollution emanating from the dumpsite. CO_2 concentration levels in both investigated sites exceeded the standard acceptable limit. Though the concentration levels showed similar trend in both dumpsites, higher concentration values of CO_2, CH_4, H_2S and PM10 were recorded at the

Olusosun dumpsite, which could be associated with the age, volume of the waste and its nearness to metropolis. The topographical nature of the dumpsites (upland and wetland) appears not to have an impact on the air quality values measured. The perception of the residents in both dumpsites is concerned about the living and carrying out their daily operations in and around the dumpsites. Therefore an extensive public awareness/sensitization program should be carried out on the sources of dumpsite emission, its hazard to human health and the environment coupled with personal efforts to protect residents. A strict enforcement of existing legislations guiding air pollution can be put in place such as air pollution monitoring stations. Finally, the use of dumpsite methane gas as an alternative to cooking gas through the participation of the private sector can be promoted.

Data availability statement

Data will be made available on request.

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Conflicts of interest

The authors declared that there is no conflict of interest.

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