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The Risk of Residing in Proximity to Illegal Waste Dump Site in Sabon Wuse, North-Central, Nigeria

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Abstract

This study investigated the spatial distribution of solid waste dump sites in the study area, established the residents' perceived level of exposure to solid waste hazards, and the effect of living near refuse dump sites. Systematic random sampling technique was used to administer 500 questionnaires to the households in the study area. The result of the study indicated that there is only one legal dump site located in Buntu area; there are 19 illegal dump sites within the town. The proliferation of illegal dumpsite was as a result of convenience and open spaces within the town. The most frequently used method of waste disposal is on weekly basis. The use of plastic bucket is favoured for storage. The level of health risk associated with living close to dumpsite shows that a total of 878 houses are at the severe risk, while, 1,898 houses are at mild risk level. The study concludes that There should be a total clearance of the existing illegal dump site and proper monitoring of the waste management in the town to forestall illegal dumping, and adequate information to residents and awareness on the danger of consequences of indiscriminate dumping of refuse in an undesignated dump site.
Keywords: Illegal Dump Site, Solid Waste, Waste Management, Environment, Urbanisation.

Introduction

Waste generation is a result of consumption of resources and other activities of mankind. As this is an unavoidable event in day to day living, there is need for waste generated to be managed. Lack of proper management of waste always results in environmental and health challenges. Globally, the process of waste management requires a chain of activities from collection, sorting, transporting and disposal. If any of these lines of management is disrupted, it affects the management of the waste. How this may be efficiently done poses a problem in many societies today. Another natural process, population growth, makes waste management even more challenging; more people in a specific geographic location would imply a higher level of waste generated, hence more waste to contend with in that area. As poorly managed wastes are perceived as environmental hazards of high significance, the societies' inability to manage waste generation effectively play no small role in increasing extant environmental pressures (Karanjit *et al.*, 2007).

The double function of Sabon Wuse as the Local Government Headquarters and the resettlement of displaced people from Abuja due to its proximity to the Federal Capital has increased the population of the town and thereby increased the solid waste being generated. The responsible agencies, such as Niger State Environmental Protection Agency (NISEPA) and Tafa Local Government Council Public Health Department did not have any improvement in the capacity to handle the massive garbage being generated in the town. The local Government and NISEPA could not control the urban development as well as waste disposal sites that are scattered all over the town, which resulted into poor and unclean environment.

General Concept of Waste

Waste generally is an unwanted by-product of man's activities. It is defined by Lutui (2001) as "materials that currently have negative value to their owner, that is the generator incurs costs in managing them (importantly this does not prevent them from having positive value to another owner at another location in space or time)" (Lututi, 2001: p3) and are disposed of. Solid waste is a matter of time and places, as what is a waste can become raw material in another place. For example, the recycling plant uses solid waste product as raw material for production of other items (Sanusi, 2010). Research has shown that there are two different variance of waste, that is, solid waste (effluence) and liquid waste (foul water, semi- liquid and the gaseous liquid Biogas). "Waste" does not have a generally concise definition, however waste is generally known to be any unwanted material (Lutui, 2001).

Morrisson, Wray, Dever, and Dusbaun (2000) define waste as "any matter prescribed to be waste under national legislation, any material listed as a waste in appropriate schedules, and in general, any surplus or reject material that is no longer useful and which is to be disposed off". This definition uses two words that is important to this study "waste is neither wanted nor has value to the owner" and which in turn need to be disposed off. Waste has an unwelcome and often unnoticed effect on the environment and hamper development and civilization (Kim and Gobalan, 1997) and can be traced to the growth of industrialization in modern economies (Holmes, 2000).

Solid Waste

Solid waste could be defined as any non-liquid and non-gaseous substance produced out of human activities which are regarded as being useless. It could take the form of garbage, refuse, and sludge (Nwosu and Olofa, 2015). Solid waste can also be regarded as materials, which are no longer in use. This includes household garbage, unwanted materials from commercial and mining activities. Solid wastes are categorized in to three (3) types, based on the composition. These are:

i. Biodegradable; mainly composed of green waste, garbage, trash.
ii. Non-biodegradable; this consist of scraps, synthetic (plastic, rubber, leather) materials, metals etc.
iii. Semi-biodegradable; this consist of rubbish (paper, cartons, wood.)

Solid waste can also be defined as those materials that are generated, resulting from man's activities and are not in form of liquid or gas but are compacted and substantial.

Types of Solid Waste

i. Domestic Solid Waste: These consist of rubbish and garbage from household (i.e Municipal waste). Other examples are reminant of food materials, old newspapers, spoilt kitchen utensils, cartoons, baby toys etc. it is always the principal focus of solid waste management till date (Abdrazack, Yusuf and Utange, 2013). In Sabon Wuse, The Niger State Environmental Protection Agency are those that are saddled with the responsibility of collection and disposal of Municipal solid waste management.
ii. Agricultural Solid Waste: These waste resulting from different agricultural activities, include cultivated waste (weed); harvested wastes from plants, field and tree crop wastes; the dung from Animal production and waste from operation of feed lots as described by United

Nation Environmental Programme (UNEP, 2010).

iii. Commercial Solid Waste : These include all solid waste which emanate from business and profit making activities such as financial institution (Banks, market, stores, super market), educational institution (theatres, lecture halls and class rooms), hospitals (Abdrazack *et al.*, 2013)

iv. Industrial solid waste: These are solid waste product from the production of goods. They include all solid waste which result from both light and heavy industries. In most developed countries, industrial solid waste account for the most divasting tonnes of general waste hazards. In the USA for examples, industries generate one third of the general waste produced in the country. They are mostly as a result of industrial processes of manufacturing operation inherent in the country. Examples of such operations are: processing plant, repair and clearing establishment, refineries, manning and mineral operations (UNEP, 2014).

v. Special Solid Waste: These types of waste comprise of waste from street sweeping, road side litter, debris, dead animals, abandoned vehicles and litters of store drains. They are called 'special waste' because it is impossible to predict where they will be found (Abdrazack *et al.*, 2013).

Literature Review

Rapid increase in the types and volume of domestic waste (either liquid or solid waste) as a result of continuous economic growth, urbanization and industrialization, is becoming an escalating problem for national, state and local governments to ensure effective and sustainable management of waste. In the year 2006, it was estimated that the total amount of municipal solid waste (MSW) generated worldwide reached 2.02 billion tons of waste, representing a 7% annual increase since 2003 (Global Waste Management Market Report, 2009). It was further estimated that between year 2007 and 2011, global generation of municipal waste would rise by 37.3%, equivalent to roughly 8% increase per year. Based on incomplete reports from its participants, The Basel Convention estimated that about 318 and 338 million tonnes of solid waste were generated in 2001 (World Bank, 2010).

Owing to an increase in human population, industrial and technological revolutions, waste management has become increasingly complex (Akinbile and Yusuf, 2011). Marshall and Farabahksh (2013) observed that population growth and subsequent innovations have not only led to changing consumption patterns across borders but have also placed considerable pressure on waste management services. This is so because as the world races towards its urban and more complex future, the by-product of the urban lifestyle, waste, is growing at even faster rates. At present, global solid waste generation is growing approximately at 1.3 billion tonnes per year and is expected to double by the year 2025 (Hoornweg and Bhada-Tata, 2012). The pressure placed on waste management services has consequently led to widespread inefficiencies that are mainly due to lack of funds, improper infrastructure, inadequate waste collection services, unlicensed waste management activities, insufficient waste minimisation and limited waste related legislation (Nahman and Godfrey, 2010). Inefficient waste management services have also led to extensive illegal dumping. According to Zurbrugg (2002), illegal dumping refers to an instance where solid

waste is disposed of in inappropriate manners in places such as in drains, roads, near rivers and on private and public land that is not legally approved for such a use. Dumped materials typically include furniture, garden waste, discarded appliances, household rubbish, building rubble, broken glasses, old tires, hazardous materials such as illegal pestilences, and metal contamination and abandoned automobiles (United States Environmental Protection Agency, 1998).

Illegal dumping of waste products is a recognised problem in much of the world and Nigeria. At a global level, dumping has resulted in increased costs associated with clearing and clean-up efforts. For instance, in Britian, clearing waste that is dumped every 35 seconds has cost the government millions according to the British Broadcasting Corporation (BBC news, 2005). There have also been instances of developed countries dumping waste in the less developed countries. A recent occurrence is the dumping of old and broken television sets in Ghana by one of the United Kingdom's leading waste and recycling companies. This is said to have been done in violation of the laws in relation to the flow of waste to developing countries (Wasley, 2011). In the city of Abidjan in Côte d'Ivoire, vast amounts of toxic waste released by a tanker registered under a Dutch Oil Trader resulted in the death of ten people and left many others suffering from diarrhoea, vomiting and nosebleeds (Johnson, 2006). It is uncertain as to how the toxic pollutants entered the country. Such occurrences thus make it important for countries to monitor and to enforce policies that ensure proper waste disposal services. Bylaws for illegal dumping are clearly presented, but the enforcement of these regulations is unclear.

Dumped solid waste has serious implications for the health, environment and the quality of life. Dumped solid waste contaminates both soil and water. This occurs when water from rainfall seeps through dump waste and mixes with substances within the waste and forms a substance known as leachate. According to Akinbile and Yusuf (2011), leachate released from waste sites also poses a high risk to groundwater and surface water if it is not properly managed. Dumpsites also make the surrounding areas prone to flooding as the different components of waste can block drains, creeks and culverts (United Nations Environment Programme, 2005). In an attempt to combat illegal dumping and mitigate its effects, residents in rural areas burn sites. This, however, has a direct impact on the environment because fires cause severe erosion due to burning of trees which limit vegetation growth. Small animals such as birds are also affected as they die from feeding on materials from waste sites and by being stuck in debris (Project Green Sweep, 2011).

The presence of an illegal dumpsite can cause serious health problems for nearby residents as it is an ideal breeding ground for disease-vectors such as rats and mosquitoes (United States Environmental Protection Agency, 1998). Certain respiratory illnesses such as asthma and tuberculosis are also linked to illegally dumped waste (Etengeneng, 2012). The occurrence of illegal dump sites not only affects health and the environment, but also the quality of life. According to Madava (2001), illegal dumpsites have adverse effects on the basic human rights of people with regards to the standard of living. This is so because hazardous wastes are prospective pollutants of the biophysical and human environment. This is so because the presence of dumpsites does not only

deteriorate the quality of the environment, but also breaches human rights as it has an impact on community pride. More often than not, the sight and smell that emerge from illegal dumpsites are unpleasant and diminish the land value. Illegal sites that mostly constitute of flammable substances and gases are vulnerable to fires. More also as stated by United State Environmental Protection Agency (USEPA), the impact is not limited to the aesthetic appeal of landscapes, but also diminishes the value of surrounding properties significantly, forcing residents to vacate their homes to further places (USEPA, 2005).

The situation in Nigeria is different in that the process of urbanisation in the country is unplanned; there is population explosion as decentralisation of government has turned villages to local government headquarters thereby attracting more people to the urban centres (Okpala, 2004). This has led to high production of solid waste, the traditional attitude, poverty and high level of ineptitude on the agency responsible for waste management has contributed significantly to turn our towns and cities to garbage cities rather than serene environment (Oyelola, and Babatunde, 2013). Table 1 shows the level of waste generation in some selected cities in Nigeria. There are many illegal waste dump sites round the cities. The population of the cities are grasping with the environmental and health risks associated with unclean environment. This has led to breeding of pathogenic condition (breeding ground for mosquitoes, rodents and airborne diseases (Ogwuelika, 2009).

Table 1: Volumes of solid waste generated in some Nigerian cities (Tonnes/year)

Cities	Tonnage/ Month	Density	Kg/Capital day
Lagos	255,556	294	0.63
Kano	156,676	290	0.56
Ibadan	135,391	330	0.51
Kaduna	114,433	320	0.58
Port/Court	117,825	300	0.60
Makurdi	24,242	340	0.48
Onitsha	84,137	310	0.53
Nsukka	12,000	370	0.44
Abuja	14,785	280	0.66

Source: Ogwuelika, 2009

Table 1 has clearly shown that the city of Lagos generates more waste than every other cities in Nigeria due to population of the state. It is worthy to know that Kano has a larger population when compared with Lagos state but Lagos state generates more waste than Kano. Ogwueleka concluded that, on the average the Southern part of the country generates about 0.63 kg per capita per day while the Northern part produces about 0.56 kg per capita per day. On the average, the country produces about 0.60 kg per capita per day.

Study Area

Sabon Wuse is a Community in Tafa Local Government Area of Niger State, Nigeria, adjoining the Federal Capital Territory Abuja. It is located on latitude 9^0'33"N and longitude of $71^0$51"E with the projected population of 71,074 people as of 2015 (NPC, 2011). The geographical location of Sabon Wuse is shown in Figure 1 in the context of Nigeria and Niger State. The study area has a long range of hills and ridges on the western side of the town, which serve as restrictions to physical development in that part of the town. Presence of many slopes and valleys in the town encourage rapid erosion and formation of gully channels that are common in the town. Incidence of flash floods is a common occurrence especially in high density areas. While farming remains the chief occupation in Sabon Wuse, the town is noted for mat making and export of cotton weaving and dyeing.

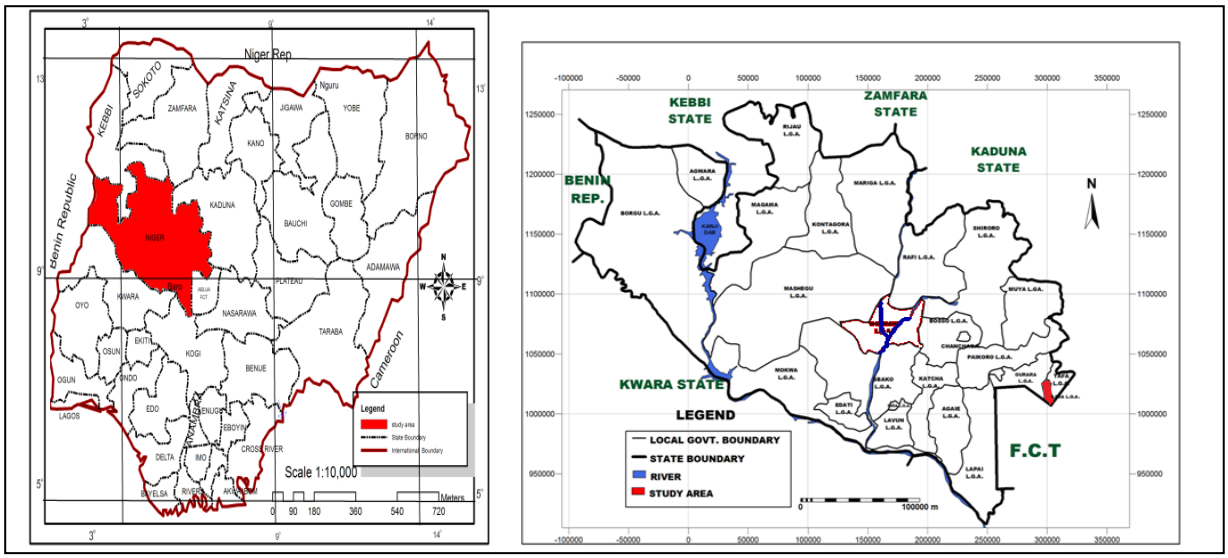

Figure 1: Location of Sabon Wuse in the National and State context
Source: URP Dept. FUT Minna.

Research Methodology

The methodology adopted for the study was a mixed-methods approach which integrated Geographical Information Systems (GIS) mapping, qualitative and quantitative research (Bryman, 2006). This approach was selected to ensure that the data presented a holistic view of the issue at hand. In order to map out illegal dumpsites throughout the town, the town was divided into four neighbourhoods and all illegal dumpsites within the neighbourhoods were identified. The GPS co-ordinates of each illegal dumpsite were then taken and recorded using a hand-held GPS. The co-ordinates of the dumpsites were then entered into Geographic Information Systems (GIS) software called ArcMap. This software used the coordinates to generate a map displaying the location of each dumpsite, the coordinate of each refuse dump point, height of the refuse dumpsite and area coverage of each refuse dump site. Systematic random sampling technique was adopted in administering a set of pre-tested questionnaire on households living near the dump sites. To do this, ten of the twenty illegal dumpsites in the town were randomly selected from the four neighbourhoods in the town. A set of self-administered questionnaire designed to include dichotomous, Likert rating, checklist and open-ended questions, was used to obtain primary information on respondents' attitudes and views on solid waste dump sites. Forty residential buildings within the closest proximity (as the crow flies) from all the dumpsites were purposively selected. A household was randomly sampled in each of the selected building and the household head provided the required data. It was only in the absence of the head that available oldest adult member of the household was interviewed. 500 copies of the questionnaire was administered out of which 370 copies were correctly filled, returned and used for analysis of the study. Both descriptive and inferential statistics (Analysis of Variance and Tukey Post-Hoc tests) were used in analyzing data collected at $p \geq 0.05$.

The level of exposure to environmental and risk hazard when living in proximity to dump site was measured using Chung and Poon (2001) scale. The scale measured the

distance to dump site to determine the level of rsk and exposure to hazard thus:

i. 0.00 - 50.00 metres = Very Severe Risk
ii. 50.01 – 100.00 metres = Severe Risk
iii. 100.01 – 150.00 metres = Moderate Risk
iv. 150.01 – 200,00 metres = Mild Risk
v. >250.00 metres = No Risk

Research Findings and Discussion

Results of the study are presented under four main headings: Spatial distribution of illegal dumpsites; Assessment of solid waste disposal method; Residents' perception of level of exposure to solid waste hazards; and, Effects of living near solid waste dump sites.

Spatial Distribution of Waste Dump in Sabon Wuse

Investigations conducted by the researchers revealed that although there is only one legally recognized solid waste dump site in Sabon Wuse town, nineteen illegal ones were identified by the authors. Spatial distribution of the dump sites are presented in Table 2 and Figure 2. From Figure 2, it is revealed that illegal dumpsites of solid waste were found throughout inhabited parts of the town. Distance of the legal dumpsite and inadequate enforcement of environmental sanitation laws and edits, especially in relation to illegal dumping of solid wastes, might be responsible for the proliferation of illegal solid waste dump sites in the town.

Table 2: Spatial Location of Solid Waste Dump Site in SabonWuse

S/N	Location of the Dump Site	Status of Dump Site	Location and Coordinate of Dump Site		Size of the Dump Site				
			Northern	Eastern	Length (m)	Breath (m)	Area (m^2)	Height (m)	Vol. of Waste (m^3)
1	Buntu	Legal	9°17.932'N	7°13.707'E	100	70	7,000	3	21,000
2	AngwanYashi	Illegal	9°18.265'N	7°14.430'E	5	3	15	1	15
3	Katampe	Illegal	9°18'290"N	7°14.876'E	10	5	50	1	50
4	Katampe Bridge	Illegal	9°18.125'N	7°14.718'E	12	6	72	1	72
5	Aso	Illegal	9°17.962'N	7°14.575'E	50	20	1,000	1	100
6	Behind SarkinAso House	Illegal	9°17.884'N	7°14.542'E	40	30	1,200	5	6,000
7	Central Mosque Aso	Illegal	9°17.924'N	7°14.417'E	20	11	220	1	220
8	AngwanTofa	Illegal	9°17.997'N	7°14.096'E	70	45	3,150	4	12,600
9	Behind Aso Market	Illegal	9°18.169'N	7°14.228'E	10	4	40	1	40
10	AngwanYashi	Illegal	9°18.327'N	7°14.365'E	10	5	50	1	50
11	Hausawa	Illegal	9°18.535'N	7°14.366'E	4	2	8	1	8
12	Abuja Kaduna Expressway	Illegal	9°18.591'N	7°14.388'E	6	3	18	4	72
13	Abuja Kaduna	Illegal	9°18.574'N		18	2	36	3	108

	Expressway			7°14.389'E					
14	Abuja Kaduna Expressway	Illegal	9°18.549'N	7°14.367'E	16	4	64	1	64
15	Abuja Kaduna Expressway	Illegal	9°18.529'N	7°14.345'E	5	3	15	1	15
16	Abuja Kaduna Expressway	Illegal	9°18.525'N	7°14.343'E	20	10	200	4	800
17	Abuja Kaduna Expressway	Illegal	9°18.494'N	7°14.318'E	40	20	800	8	6,400
18	Abuja Kaduna Expressway	Illegal	9°18.477'N	7°14.307'E	15	7	105	4	420
19	Abuja Kaduna Expressway	Illegal	9°18.484'N	7°14.293'E	6	4	24	2	48
20	Abuja Kaduna Expressway	Illegal	9°18.472'N	7°14.282'E	12	8	96	5	480

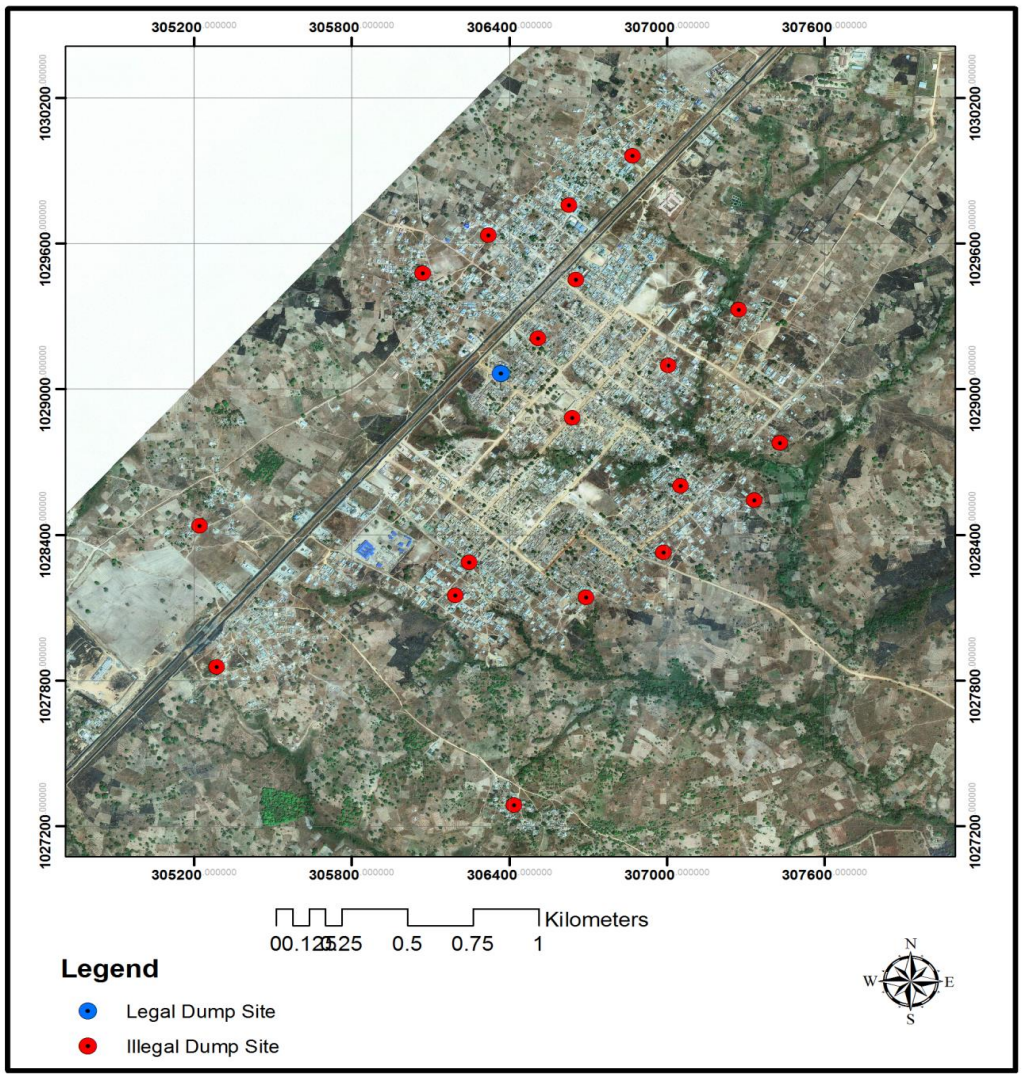

Figure 2: Spatial location of both legal and illegal waste dump site in SabonWuse

Assessment of Solid Waste Disposal Methods

Solid Waste Disposal Methods in the Study Area

Table 3 shows the level of assessment of waste collection and disposal in Sabon Wuse. The analysis indicated that 21.4% of respondents dump their solid waste to an informal collector on daily basis; about 61.7% dump their solid waste indiscriminately on weekly basis which is a clear indication that they often dump their waste when they are less busy which happens that be Saturday and Sunday when they do not go to work, While 14.9% on fortnightly, this deal with dumping of refuse at any time they were able to see the informal refuse collectors which does really have a prescribed day and 6.0% on monthly basis.

Table 3: Frequency of Waste Disposal in Sabon Wuse

Frequency of Disposal	Number of Respondents	(%)
Daily	79	21.4
Weekly	228	61.7
Fortnightly	55	14.9
Monthly	7	1.9
Total	**370**	**100.0**

The most used municipal waste storage facilities in the study area are; Plastic Bucket (23.4%), Cotton Sack (18.2%), Nylon Bag (21.4) and Bagco Bag (11.7%), reasons being that they are easy to convey to various area of disposal because of their light weight and they are less expensive and very few people in the study area are aware of the undesignated dump site so they are often saddled with no option than dumping it off available place of their choices. Table 4 shows various storage facilities used by households in Sabon Wuse.

Table 4: Method ofWaste Collection in SabonWuse

Storage Facilities	Number of Respondents	(%)
Palm Tree Front Basket	24	6.5
Plastic Bucket	87	23.4
Cotton Sack	67	18.2
Drum	60	16.2
Nylon Bag	79	21.4
Bagco Bag	43	11.7
Others	10	2.6
Total	**370**	**100.0**

Risk Associated with Illegal Solid Waste Proximity to Houses in SabonWuse

Figures 3 and 4 show the extent of closeness of compounds to refuse dump in the study area. The risk of staying close to refuse dump was measured between 100 meters and 200 meters. The risk ranges from fatal, severe and mild (Chung and Poon, 2001). Satellite image of the study area was used to capture the number of compounds that were within the 100 meters (Severe) and 200 meters (mild) risk. This process is known as buffering. The buffering uses radius to determine the area of coverage. The total numbers of structures at the study area is 3,571. The total number of compounds at severe risk (100m) is 878 which is 24.6% and at mild risk (200m) is 1,898which is 53.2% of the total number of structure within the study area. Dumped and untreated solid waste has serious implications for the health, environment and the quality of life of people, therefore, Chung and Poon, 2001 indicated that residents within the buffering region of the refuse dump at 100m are at higher risk than those at 200m distance. This is due to the fact that level of exposure to hazard is high, hence the ability of rodents and other vectors to transmit infections is also high. The implication of this is that the closer the residents to dump site the higher the risk of both environmental and health hazard in Sabon Wuse.

The analysis of the proximity to risk of exposure to hazard is measure using the buffer analysis as shown in Figures 3 and 4. The buffer that was used followed the 100 metres and 200 metres risk zones. The 100 metres shows a severe risk associated with living within the catchment of such environmental and health risk, while, 200 metres buffer on the other hand shows a mild risk of exposure to both environmental and health risk as posited by Chung and Poon (2001), it is better to avoid living in an area where there is risk whether mild or s evere.

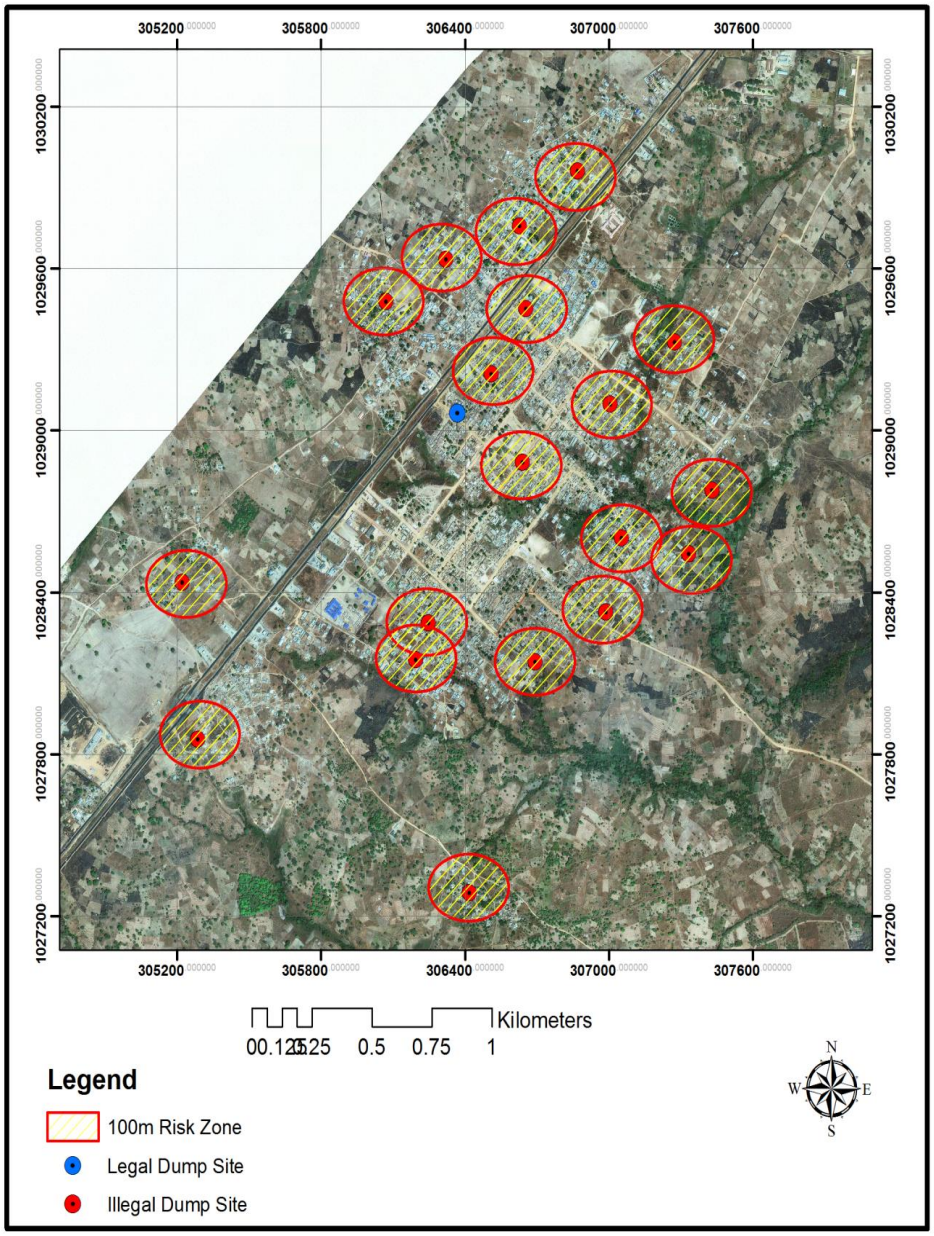

Figure 3: 100m Risk radius showing houses closer to waste dump site in Sabon Wuse

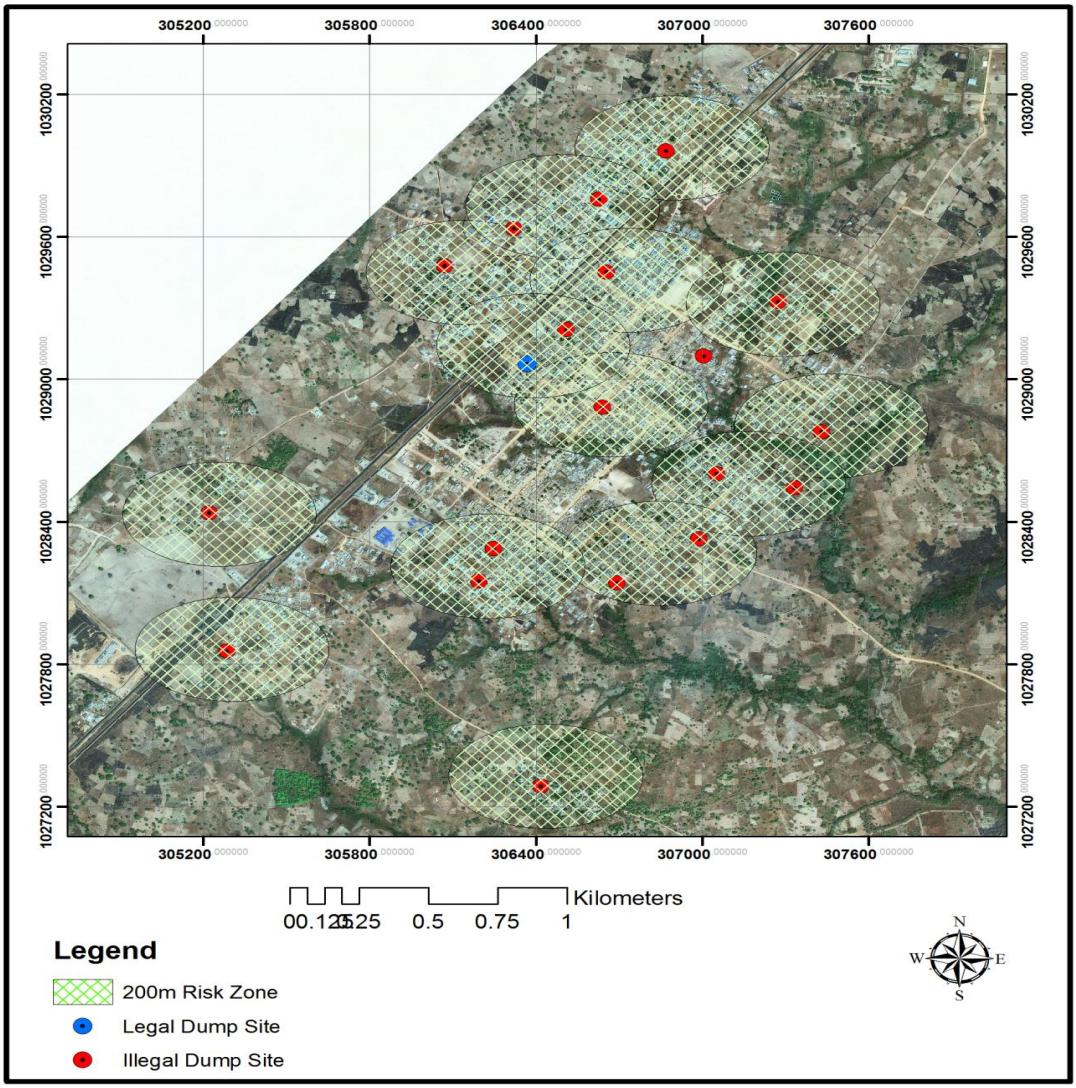

Figure 4: 200m Risk radius showing houses closer to waste dump site in Sabon Wuse

Residents' Perception of the Types of Hazard Exposed to in the Study Area.

Table 5 shows the perception of residents to various risks of exposures to solid waste hazard in the study area. The extent of perception of the risk is measured using Linkert Scale. The range of the scale is Strongly Agreed (SA); Agreed (A); Fair (F); Disagreed (D) and Strongly Disagreed (SD).

The specific risk and hazard exposed to by the residents based on their perception include the following: Foul water, Dust during hamattan, Dust at the beginning of rainy season, Dust at the end of rainy season, Rats and Rodents attack, Houseflies, Mosquitoes, Defacing the physical appearance of the environment, Children playing off the dump, Injuries from sharp objects of the dumps, Pollution of water bodies and Smoke from burning of the waste.

Table 5: Residents' Perception of the Type of Hazard exposed to in the Study Area

S/N	Hazard	Fixed Hazard Grade (1-5)					Ground Total
		SA	A	F	D	SD	
1	Domestic Sewage	47	89	62	130	41	370
2	Sand Dust	29	26	202	60	53	370
3	Erosion	38	50	38	67	187	370
4	Poor Physical Apperance of the Environment	199	24	103	17	24	370
5	Children Playing on dump sites	7	19	48	125	171	370
6	Rats and Rodents	7	46	38	55	223	370
7	Mosquito Breeding	147	72	50	82	19	370
8	Houseflies	113	159	55	14	29	370
9	Injuries from Sharp Objects	5	14	19	183	149	370
10	Epidemics	7	34	46	84	199	370
11	Pollution of Water Source	17	7	10	130	206	370
12	Smoke from burning of solid waste (open dump)	31	10	50	58	221	370

Table 6 shows the responses of the residents in respect to their exposure to hazard of solid waste. These data are known as Variable Numbers of Respondents (VNR) and the Fixed Hazard Grade (FHG) is ranged from 1-5 of which 5 is the most dangerous. The procedure of calculation of the households level of exposure to solid waste Hazards is shown thus:

$$AG = \frac{\sum FHG \, X VNR}{(SS_o)} \qquad (1)$$

Actual Grade (AG) = Fixed Hazards Grade (FHG) X Variable Numbers of Respondents (VNR) / Sample Size (SSo)

Where;

Fixed Hazards Grade (FHG): ranging from 1 to 5, were '1' is Very Good; '2' Good; '3' Average; '4' Very Poor and 5 is Extremely Dangerous.

Variable Numbers of Respondents (VNR): the total number of responses for each grade.

Sample Size (SS_o) - it is referred to as the sample size of the study area, which is 370.

Table 4 also shows that erosion, children playing on the dump, injuries from sharp objects of the dumps fall within the fair condition, meaning that their effect as a result of the presence of these refuse dumps is minute/ fair on the people around that area. In the same vein, it shows that: foul odour, dust at the beginning of rainy season and house flies falls with the average condition, which indicate that most of the just itemized hazards exist on an average scale in the study area as a result of those refuse dumps being present in that area.

In addition, Table 4 also indicates that: dust during hamattan, rats and other rodent outbreak, mosquitoes, defacing the physical appearance of the environment, pollution of water and smoke from burning of waste fall within the very bad condition on the ranking scale, which means that there is a very high existence of health hazards due to the presences refuse dump sites in the study area. It has made the area susceptible solid waste hazard and if urgent measures are not taken, it would be more terrifying in the nearest future.

Table 6: Households Level of Exposure to Solid Waste Hazards

S/N	Hazard	Fixed Hazard Grade (1-5)					Actual Grade
		Poor	Fair	Average	Very Bad	Extremely Dangerous	
1	Domestic Sewage	.13	.48	.51	1.40	.55	3.07
2	Sand Dust	.01	.08	.16	1.97	2.01	4.23
3	Erosion	.08	.14	1.64	.65	.71	3.22
4	Poor Physical Apperance of the Environment	.02	.18	.37	.91	2.69	4.18
5	Children Playing on dump sites	.31	.86	.45	.12	.39	2.12
6	Rats and Rodents	.02	.25	.31	.73	2.53	3.95
7	Mosquito Breeding	.10	.10	.39	1.35	2.31	4.17
8	Houseflies	.02	.25	.31	.60	3.02	4.19
9	Injuries from Sharp Objects	.40	.39	.41	.88	.26	2.34
10	Epidemics	.54	.13	.84	.18	.36	2.05
11	Pollution of Water Source	.05	.04	.08	1.40	2.79	4.36
12	Smoke from burning of solid waste (open dump)	.08	.05	.41	.62	2.99	4.16

Perception of Residents to Solid Waste Hazard in Sabon Wuse

Table 7 shows level of health hazard exposed to when residing close to dump site in the study area. The health hazard exposed to varies,and it included the following: fear of disease, discomfort from foul odour, irritation from the sight of the dump, fear of people leaving the neighbourhood, fear of persecution by the environmental sanitation body, the neighbourhood being repulsive to needed businesses, friends and relatives not wanting to visit.

Table 8 shows the response of the residents to risk of health hazard when residing close to refuse dump in the study area. The variable was then grouped as Variable Numbers of Respondents (VNR) and the Fixed Hazard Grade (FHG) is ranged from 1-5 of which 5 is the most dangerous. The total number of respondent is 370. The procedure of its calculation and judgement follows the same procedure.

Table 7: Residents' Perception to Level of Health Hazard in the Study Area

S/N	Perception of Risk Exposed to	Fixed Hazard Grade (1-5)					Actual Grade
		Poor	Fair	Average	Very Bad	Extremely Dangerous	
1	Fear of disease	12	38	101	144	75	370
2	Discomfort from foul Odour	22	34	139	82	175	370
3	Irritation from the sight of the dump	26	12	79	197	113	370
4	Fear of people leaving in the neighborhood	34	77	108	86	65	370
5	Fear of persecution by the environmental sanitation body	26	82	77	82	103	370
6	The neighborhood being repulsive to needed businesses	31	10	43	127	159	370
7	Friends and relatives not wanting to visit my family	26	14	67	123	139	370
8	Blocking of roads	21	46	53	151	99	370

The result of Table 8 also shows that fear of disease, discomfort from foul odour, irritation from the sight of the dump, fear of people leaving the neighbourhood, fear of persecution by the environmental sanitation body, friendsand relatives not wanting to visit and blocking of roads falls within the average condition, it therefore indicate that due to the presence of the refuse dump the area suffers the just listed health hazard in an average manner, that is to say, the occurrence are minimal though exist in that area. Furthermore, The Table 8 shows that only one falls within the very bad condition, this indicates that the presence of the refuse dump has made the neighbourhood to be repulsive to needed businesses. According to the popular Nigerian saying "The eyes eat before the mouth". Due to the unpleasant odour, unpleasant view and other environmental deterioration caused by the present of the refuse dump, this has drastically harper business activities with the affect area of the study area.

Recommendations

Based on the findings of this study, the following recommendations are hereby proposed;

There should be a total clearance of the existing illegal dump sites and proper monitoring of the waste management in the town to forestall illegal dumping. The offenders of this provision should be punished to serve as a deterrent to others. There should also adequate information to residents and awareness on the danger of consequences of indiscriminate dumping of refuse in an undesignated dump site. System of refuse collection by the responsible agency that is Niger State Environmental Protection Agency should be improved upon to include door to door system of refuse collection, putting into consideration durable storage facilities.

Regular evacuation of the solid waste from dump site by the government and its agency. Prompt and timely evacuation of municipal solid waste from residence to the nearest landfill and sorting of the waste to reduce the time of decomposing and recycling of recyclable waste. It should be noted that if there is a delay or irregular frequency in evacuation of municipal solid waste, it might lead to the temptation of residents returning back to their usual habit of indiscriminate refuse dumping.

Table 8: Residents' Level of Risk of Health Hazard Exposed to in the Study Area

S/N	Hazard	Fixed Hazard Grade (1-5)					Actual Grade
		Poor	Fair	Average	Very Bad	Extremely Dangerous	
1	Fear of disease	.03	.21	.82	1.56	1.01	3.62
2	Discomfort from foul Odour	.06	.18	.47	.88	2.40	3.99
3	Irritation from the sight of the dump	.07	.05	.64	1.51	1.53	3.80
4	Fear of people leaving in the neighborhood	.09	.42	.88	.94	.88	3.19
5	Fear of persecution by the environmental sanitation body	.07	.44	.42	.88	1.40	3.21
6	The neighborhood being repulsive to needed businesses	.08	.05	.35	1.38	2.14	4.01
7	Friends and relatives not wanting to visit my family	.07	.08	.55	1.32	1.88	3.90
8	Blocking of roads	.06	.25	.43	1.64	1.33	3.70

Conclusion

The study has been able to establish that there is one legal and 19 illegal dump sites in Sabon Wuse Area despite its close proximity to Federal Capital of Nigeria and influx of people to the town. The quantity of waste generated shows that it ranges between 0.52 kg/capita/day and 0.62 kg/capita/day.The result also shows that dumping of solid waste into the surrounding is the most favoured method. There is also the use of informal waste collectors who also dump the waste in the illegal dump sites in the town. The perception of the residents to the risk of staying close to refuse dump varies between severe (at 100m) and mild (at 200m). The total number of buildings exposed to the risk of both environmental and health hazard is about 25.6% at 100 m and about 53.2% at 200 m buffer. This shows that a greater number of residents are exposed to danger on health and environmental hazard. This has an effect on the health care delivery as many residents are prone to mosquito attack and epidemic as a result of houseflies.

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