

Modified Risk Matrix of the Impact of Refuse on Human Health in Elioizu Community, Port Harcourt

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ABSTRACT

The study developed a risk matrix for description of the impact of refuse on human health in Elioizu community in Port Harcourt. From the risk matrix, it was revealed that the dump refuse contains contaminants such as heavy metals, hydrocarbon and sulphates. The assessed risk level in the matrix ranged from low to moderate. The probability of occurrence and impact of the elements of the risk in the waste were ranged from low to high. In the study, risk matrix was developed by combining interview, questionnaire survey, observational and desktop studies methodologies. Per the survey, 44.4% of the participants indicated a close proximity (<50m) of dumpsites to their homes. This was followed by 35.6 percent who also indicated that dumpsites were just about 50-250 meters away from their homes. About 53% of the respondents highlighted that the problem is moderate, 23% indicated that the problem is severe, whereas 24.5% indicated that the problem is minor. In the same vein, participants highlighted that health problems, unpleasant odor and an eyesore were major problems associated with the dumpsites. The potential receptors of the assessed contaminants include: Elioizu residents, site workers and crops. Based on the study findings, it was recommended that remedial action be carried out. A waste management plan is recommended for the site that could include vigilance, the services of geo-environmental engineers at the design stage of an engineered landfill at the site. This would manage the risk at the site including odors. This study is considered amongst the first attempts at developing a risk matrix for the management of waste in Elioizu community, Port Harcourt.

Keywords: Refuse, Human-health, waste management system

I. INTRODUCTION

Refuse management is a global issue of concern. Annually, global waste generation is approximately 1.3 billion tonnes, and it is forecast to increase to approximately 2.2 billion tonnes in 2025 [7]. Waste also causes economic, environmental and financial burden for communities. In general, waste management is given a very low priority in Nigeria and most developing countries. According to [7], the cost of waste management will increase 3-4 times in developing countries from about 20 billion US\$ in 2010 to approximately 80 billion US\$ in 2025. The rate of cost increase is higher in lower developed countries. Also, climate change has become a matter of public concern, the concentration of CO₂ and Methane (CH₄) were increased 35% and 100%, respectively. According to the report of IPCC (2007), the amount of Greenhouse gas (GHG) emission from waste sector accounted for about 3% of total artificial GHG emission, in which 90% is methane gas. In terms of methane emission, waste sector only contributed around 18% globally [5], mainly from landfill and wastewater treatment facilities. Therefore, to develop a sustainable waste management system, a variety of procedures should be conducted efficiently including sampling, surveying to address the problem and obtain waste information, modelling and simulation of the reality, calculation of human health and environmental impacts of potential management options, implementation of the decision-making process. In this article, the focus will be on Elioizu Community in Port Harcourt, Rivers State, Nigeria in evaluating a risk matrix to show the risk of refuse on human health. The management of waste continues to be a major challenge in Port Harcourt and this poses a serious threat to environmental quality and human health. The complex nature of disease outbreaks; cases of diarrheal diseases in recent times [14] corroborate this fact. Sequel to

this, there is a need for a detailed study to gather data on variables that correlate refuse dumping and adverse effect on human health, focusing on Eliozu Community in Port Harcourt. Hence, the aim of this research is to develop a risk matrix to describe the impact of refuse on human health in Eliozu community, Port Harcourt. Findings from this article will be useful and beneficial to the various endeavors in Port Harcourt and Nigeria to deal with the menace of refuse and wastes, and related challenges due to unsustainable patterns of disposal. The management of Rivers State Ministry of Health and the policy makers of RIWAMA will also find the outcome of the study beneficial as regards refuse dumps effect on human health and waste management in general.

II. LITERATURE REVIEW

The city of Port Harcourt is home to about 1 million people [14]. Waste management in the city is very basic; it is not uncommon for residents to dump their wastes by the road side or simply burn them at the back of their houses. The waste management agency in Port Harcourt mainly relies on open dumps and old landfills for waste disposal. It appears that a large percentage (37.6%) of municipal solid wastes in Port Harcourt are made up of biodegradable materials (food and garden

wastes). A substantial percentage (30.7%) comprises of inorganic substances such as glass and metals as revealed in Table 2.2. A similar survey [3] found that apart from the components in Table 2.2, 7.7% of sludge and expired chemicals or drugs were also produced. [8] added that on the average, the wastes stream in Port Harcourt consists of 19.1% liquid, 66.6% volatile solids, 13.5% of fixed solids and 0.8% of other compounds. As a result of these mix in composition, [2] further argued that apart from the current disposal system in Port Harcourt, several other disposal options could be utilized in order to reduce the negative impact of the current disposal methods (landfills and open dumps) on the environment. [8] found that municipal solid wastes in the city are a rich source of energy. Likewise, a laboratory experiment [2] found that a ton of organic waste in Port Harcourt will generate about 79600 liters of methane gas with an energy equivalent of about 1592000 kJ. Therefore, it was concluded that the energy content of the wastes could be harnessed for the purpose of electricity generation. It might interest the government if they are willing, to know that the wastes that seem uncontrollable could actually be a source of useful energy.

Table 1: Sources and types of waste in Port Harcourt

Sources of wastes	Types of waste generated	Compositions	Current disposal method(s)
Commercial activities	Openmarkets, Hotels, Restaurants, Shops and other commercial activities	Plastics, Putrescible, Paper, Cardboard, Cans, Glass,	Mainly landfill and open dumps, occasional burning
Domestic	Domestic activities from household.	Plastics, Putrescible, Electronics, Wood, Textile, Furniture, Cans, Glass	Biodegradables, wood products, textiles and other non – biodegradables
Construction and Industrial activities	Small scale manufacturing and industrial activities, chemical and hydrocarbon materials, packaging materials, electrical and associated activities	Debris from demolition, concrete, polymers, organics, solvents, paints, asphalt, wood	Burying of waste, landfill and open dumps and sales of demolition debris for reuse.
Institutional	Schools – Universities such as Uniport, RSUST and other educational institutions	Large volume of Papers, Cardboards, Putrescible, Electronic wastes, plastics, cans, furniture materials etc	Landfill and open dumps

(Source: Timiebi& Anthony, 2017)

Table 2: Waste characterization in Port Harcourt

Wastecomposition	Mass(%)
Foodwaste	29.2
Paper	12.4
Plastics	9.9
Gardenwastes(grasses,wood)	8.4
Glass	13.5
Metal	17.2
Leather/rubber/textiles.	7.6
Others	1.8
Total	100

(Source: Igoniet al, 2007)

Most of the landfill operations in Port Harcourt do not have the facilities for leachate collection and treatment. The gases produced are not also captured; therefore, most landfill sites in the city are major sources of pollution [11]. Open dump sites are the most common waste disposal methods in Port Harcourt and many cities in Nigeria. According to [12], most cities in Nigeria are characterized by heaps of garbage at junctions, streets and even in drainages as a consequence of indiscriminate dumping. It is therefore not unusual to come across a huge heap of waste by the side of a major road in Port Harcourt. Mass burning This method of waste disposal is commonly practiced among residents of Port Harcourt and other cities in Nigeria [9]. The implications of current waste disposal practices in Port Harcourt are: Inappropriate wastes and waste management could result to the emission of toxic substances [10]. Dioxins which are commonly produced from many combustion processes [6] can get into the food chains by depositing on plants which are consumed by animals. When food contaminated by these pollutants is consumed over time, they cause health hazard due to bioaccumulation. Wastes produce odors, causing nuisance to nearby populations and contribute significantly to atmospheric pollution [2]. The low life expectancy in Port Harcourt and

Nigeria and the death rate after brief illnesses may not be unconnected with the poor waste management practices. Therefore, adequate attention must be given to waste management in order to safe guard human health. Ground water which is a major resource and the main source of drinking water must be protected. Attention must be directed to activities capable of compromising the safety of water resources, be it surface or ground water. Since private boreholes are a norm in the city, effort should be made towards the capture and treatment of leachate due to its toxicity

III. RESEARCH METHODOLOGY

This study adopted a descriptive survey design approach. Descriptive survey design is effective, and easy to conduct and it also ensures ease of accessing information. The study area was Elioju, Port Harcourt, Rivers State. There were (288) participants from residents selected randomly with Elioju community Port Harcourt, Nigeria using Cochran formula statistical sample technique. Two major tools (interviews and questionnaires of both structured and semi-structured nature) were used to obtain the reliability of the study. Data from the answered questionnaires were analyzed both qualitatively and qualitatively using Statistical Package for Social Sciences (SPSS).

IV. RESULTS AND DISCUSSIONS

Table 3: Descriptive Statistics Results on Perception of the people on the Problems of Dumpsite

Perceptions of the Respondents on Environment and Location of the Dumpsite		
Distance of houses from dumpsite (meters)	Responses	
<50	96	44.4%
50-250	77	35.6%
250-500	43	19.9%

Severity of the problem	Responses	
Minor	53	24.5%
Moderate	114	52.7%
Severe	49	22.7%
Urgent dumpsite problems	Responses	
Health problems	68	31.5%
Water pollution	48	22.2
Eyesore	49	22.7
Unpleasant odor	51	23.6%

Table 4: Health Impact of the Dumpsite on Respondents and Household Members

Effects on the quality of environment	Responses	
Yes	176	81.5%
No	40	18.5%
How dumpsite affects the quality of environment?	Responses	
Odor	133	61.6%
Smoke from burning	62	28.7%
Aesthetics	21	9.7%
Does dumpsite have health Impacts?	Responses	
Yes	203	93.9
No	13	6.0%
I don't know	-	-
Any sickness within the last 12 months?	Responses	
Yes	90	41.6
No	104	48.1
I don't know	22	10.2

The investigations on the health impacts of dumpsites on respondents and household members reveals the following:

- i. Dumpsites has effect on the quality of the environment
- ii. Odor and smoke from burning are the most prevalent impact of dumpsites on the environment
- iii. Lastly, dumpsites have effects on the health of individuals.

The dumpsite ground in the study area is likely to primarily consist of fill materials used in the construction of the highway (East-West Road) which are likely to be absent from the majority of the lower lying areas. It is considered that the majority of any spills would have been caught in the Motorway Drainage during construction of the expressway and it is unlikely that significant contamination would remain. General Ground Investigation has been undertaken to confirm the expected ground model. The site has been proven

to be Greenfield prior to being used as a dumpsite by the residents of the study area, that is, it was just a virgin site. No significant contamination was detected. Groundwater sampling has been undertaken on one occasion from wells in the area, volumes of groundwater were present [1]. The farm present around the dump sites is noted by the residents (respondents) to have become less arable since 2010. This could be due to the effect of the contaminants like plastics [13]. Construction workers close to the dumpsites and within the study area should still ensure that any works that need to be undertaken below ground level or within excavation are treated as confined space works and all normal confined space Health & Safety protocols are adopted including but not limited to atmosphere testing and suitable excavation support and while working vigilance should be maintained throughout the earthworks and enabling works.

V. CONCLUSION

From the risk matrix, the dumpsites contain the contaminants; heavy metals, hydrocarbon and sulfates. The pathways for these contaminants include: inhalation, ingestion, absorption and migration via solutions in ground water. The assessed risk level in the model ranged from low to moderate. The probability of occurrence and impact of the elements of the risk in the waste were ascertained. The potential receptors of the assessed contaminants include: Eliozu residents, site workers and crops.

VI. RECOMMENDATIONS

From the findings as observed by the risk-matrix, we recommend the following:

- i. Development of an efficient waste management system in order to safe guard human health.
- ii. Protection of Ground water against waste contamination
- iii. Regulation of activities/operations with potentials to ground water contaminations.
- iv. Treatment of water from boreholes are recommended as this is the major source of portable water in the area.
- v. The management of dumpsites should incorporate odor control mechanisms to reduce/minimize the risk of foul smells/inhalations.
- vi. The application of applicable Health & Safety protocols in construction, manufacturing and other form of industries with high potentials to environment pollution should be strictly adhere to.
- vii. Regular surveillance of the environment should be done to identify possible deviations in environment with proper consultations where applicable.

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