Assessment of Underground Water Quality of Gosa Landfill Site of the Federal Capital Territory, Abuja Nigeria

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Abstract: Increasing urbanization results in an increased generation of waste materials and landfills become the most convenient way of disposal. Most of these landfills are mere "holes in the ground" and do not qualify as sanitary means of solid waste disposal. Wastes placed in landfills or open dumps are subjected to either groundwater underflow or filtration from precipitation, resulting to underground water pollution. The study assessed underground water quality of gosa landfill site of the federal capital territory, Abuja Nigeria. It made use of primary data. primary data consist of water samples from the selected wells in the study area. Simple random sampling was used to select wells and boreholes in the study area. Three boreholes and three wells were selected from three communities (Hulumi, Jiyita and Paipe community) surrounding the landfill while one borehole and one well was selected within the landfill making a total of eight (8) water samples. Samples were stored in clean, sterilized, plastic bottles that were rinsed thoroughly with the samples at the collection point before actual collection. The values of total chlorine (2.19mg/l and 5.04 mg/l), phosphate (6.3 mg/l and 9 mg/l), nitrate (21.8 mg/l and 47.4 mg/l), nitrite (1.08 mg/l for well), total iron (2.7 mg/l and 1.68 mg/l) and lead (1.99 mg/l and 1.08 mg/l) for borehole and well respectively of the dumpsite are above safety standard set by Federal Ministry of Environment (fme). The value of dissolved oxygen in borehole of Hulumi (7.82mg/l) well of dumpsite (7.51mg/l), borehole of Jiyita (7.82) and borehole of Paipe (7.57mg/l) are above the safety standard set by fme of 7.5mg/l. The value of chlorine, Biological and chemical oxygen demand and recorded at all sampling points is higher than safety limit set by fme of 0.2mg/l. More also, the value of copper recorded at the borehole and well of Hulumi (1.08mg/l and 1.55mg/l) and Dumpsite (2.83mg/l and 1.3mg/l) are higher than value for safety standard set by fme. Water of all sample sites contains significant amount of total coliform count and Fecal Coliform Count with dumpsite recording highest value of total coliform count of 1600ml and 160ml for well and borehole and fecal coliform count of 6.9 X 102ml and 4.90 X 102ml) for well and borehole respectively. In order to reduce the rate of pollution of underground water quality in the study area construction of boreholes and wells close to septic tanks, latrines and gutters should be prohibited by the respective Government regulatory agencies, the ministry should engage in serious enlightenment campaign to educate the populace on water pollutants, effects and precautions, should in case the residents of the landfill insist in drinking water from wells within the land fill, there should be daily purification of well and borehole water in the study area through biological or chemical processes and there should be a periodic monitoring and assessment of water quality in Gosa landfill to ascertain status at every given time.

Keywords: *Ground Water, Landfill, Water Quality.*

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I. INTRODUCTION

Water is the natural and ecological resource that supports the existence of flora and fauna (plants and animals) on the planet and a fundamental necessity for human life. An average man (of 53- 63kg body weight), requires about 3 liters of water in liquid and food daily to keep healthy; Onweluzo and Akuagbazie (2010). Water makes up more than two thirds of human body weight and without water, we would die in a few days. Most people don't think about water very much, but water is much more essential to life. As a rule, you can survive weeks without food, but only a matter of days without water, Cackowski (2015). Groundwater is the water located beneath the ground surface in soil pore spaces and in the fractures of rock formation (United States Geological Survey (USGS, 2014). Groundwater is the largest available source of fresh water as two thirds of global fresh water is found underground (Annenberg Leaner, 2012). About two billion people worldwide use groundwater and up to 80% of drinking water in Europe and Russia is groundwater (Earth Sciences for Society Foundation, 2009). Once groundwater is contaminated it may forever remain polluted without remedy or treatment. Water is one of the determinants of human earth system. Diseases may spring up through water pollution, especially groundwater contaminants, and rapidly spread beyond human expectation because of its flow mechanism (Afolayan *et al.*, 2012).

Landfill practice is the disposal of solid waste by infilling depression on land. The depression into which solid wastes are often dumped include valleys (abandoned) sites of quarries, excavations, or sometimes a selected portion within the residential and commercial areas in many urban settlements where the capacity to collect, process dispose of, or re-use solid waste in a cost-efficient, safe manner is often limited. The practice of land filling system as a method of waste disposal in many developing countries is usually far from standard recommendations (Mull, 2005; Adewole,2009; Eludoyin & Oyeku,2010). A standard landfill system involves carefully selected location, and is usually constructed and maintained by means of engineering techniques, ensuring minimized pollution of air, water and soil and risks to man and animals. It involves placing wastes in lined pit or a mound (sanitary landfills) with appropriate means of leachate and landfill gas control (Alloway & Ayres 1997; Eludoyin & Oyeku 2010). Land filling of municipal solid wastes is a common waste management practice and one of the cheapest methods for organized waste management in many parts of the world (El-Fadel et al; 1997; Longe & Balogun, 2010).

Increasing urbanization results in an increased generation of waste materials and landfills become the most convenient way of disposal. Most of these landfills are mere "holes in the ground" do not qualify as sanitary means of solid waste disposal. Wastes placed in landfills or open dumps are subjected to either groundwater underflow or filtration from precipitation. The dumped solid wastes gradually release its initial interstitial water and some of its decomposition by-products get into the water moving through the waste deposit. Such liquid containing innumerable organic and inorganic compounds is called "Leachate''. This leachate accumulates at the bottom of the landfill and percolates through the soil (Mor *et al.*, 2006). Groundwater pollution is mainly due to the process of industrialization and urbanization that has progressively developed over time without any regard for environmental consequences (Longe and Balogun, 2010). Wastes of different types, mostly solid wastes are the major input of dumpsites/ landfills, with respect to the hydrological analysis of groundwater, its flows from area of higher topography towards area of lower topography, thereby bringing about the examination of the degradable materials which form leachate and contaminate the underground water.

The ideal of safe drinking water places a lot of concern on the quality water in question. In previous years, efforts were made by Nigerian Government to improve the quality status of domestic water supply in a bid to cope with demand for portable water that is ever increasing in the light of the growing population and rural-urban drift. Federal Capital of Nigeria is experiencing influx of population for administration and economic reasons with its present population of about 2,153,000 (Nigerian Demographic Profile,2014). These have placed more pressure on the need to have safe drinking water to meet up with the challenges of increasing population growth. Most part of the town is presently not connected with tap water. These people still depend on groundwater (hand dug wells and boreholes) for most of their water needs for domestic purposes, except where rain water is harvested during rainy season.

Gosa dumpsite is about 90.25 hectares of land allocated for open dumping within Idu Industrial Layout, Abuja Municipal Area Council (AMAC) in the Federal Capital Territory. For the teeming population of Federal Capital City (FCC) surrounding Gosa Community, groundwater is the major source of water supply due to none provision and availability of pipe born water by the Federal Capital Territory Administration (FCTA). The dependence on groundwater for domestic use could expose the people to wide range of water related diseases like cholera, typhoid, dysentery, and diarrhea, as it has been established that water related diseases results from the contamination of water bodies. Where anthropogenic processes (i.e landfills) can bring about the pollution of water body, it is therefore important to study water quality in these areas especially those around landfill sites to determine its impacts on groundwater quality. Hence, this research assessed how wastes affect underground water quality in Gosa dumpsite and its implication on the health of resident who consumes this water in the study area

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II. MATERIALS AND METHODS

➢ *Study Area*

The present main landfill site for FCC being supervised by AEPB is located at Gousa landfill site located in Gousa district of AMAC near the Nnamdi Azikwe International Airport, lies on latitude 9° 01’ 08.49’’N to 9° 03’ 41.04’’ N and longitude 7^0 21’ 05’’ E to 7° 22’ 59’’E.

The climate is the hot and humid tropical type. It is such that its elements have ranges that are transitional from those of the southern and northern parts of the country. The area has distinct wet (March - October) and dry (November - February) seasons with average annual rainfall of 1358.7mm and mean temperature range of between 20.70C - 30.80C (Balogun, 2001). Rainfall play a vital role with respect to agricultural activities within the study area and most farming activities highly depend on rainfall (Balogun, 2001).

Soil of the study area is influenced with_alluvial soil of Iku plains, gleysols and fluvisols. soils are complex in their degree of taxonomic variations. Drainage conditions of the soil depend on the depth of water table. The colour of the soils is modified by mottling due to poor drainage. The area has clayish and sandy loam soil texture with occasional swampy areas used for wetland (irrigated) farming. These are the upland soils of the ferruginous red tropical type, often derived from crystalline acid or sandy rocks and contained high proportion of silt. They are most suited for cereal and tuber production (Balogun, 2001).

The study area has a vast land conducive for agricultural activities. The rich and fertile land makes it suitable for cultivation of varieties of crops with large spread of fadama land estimated to be over 40,000 hectares and suitable for rice farming (CIFIIIP, 2013).

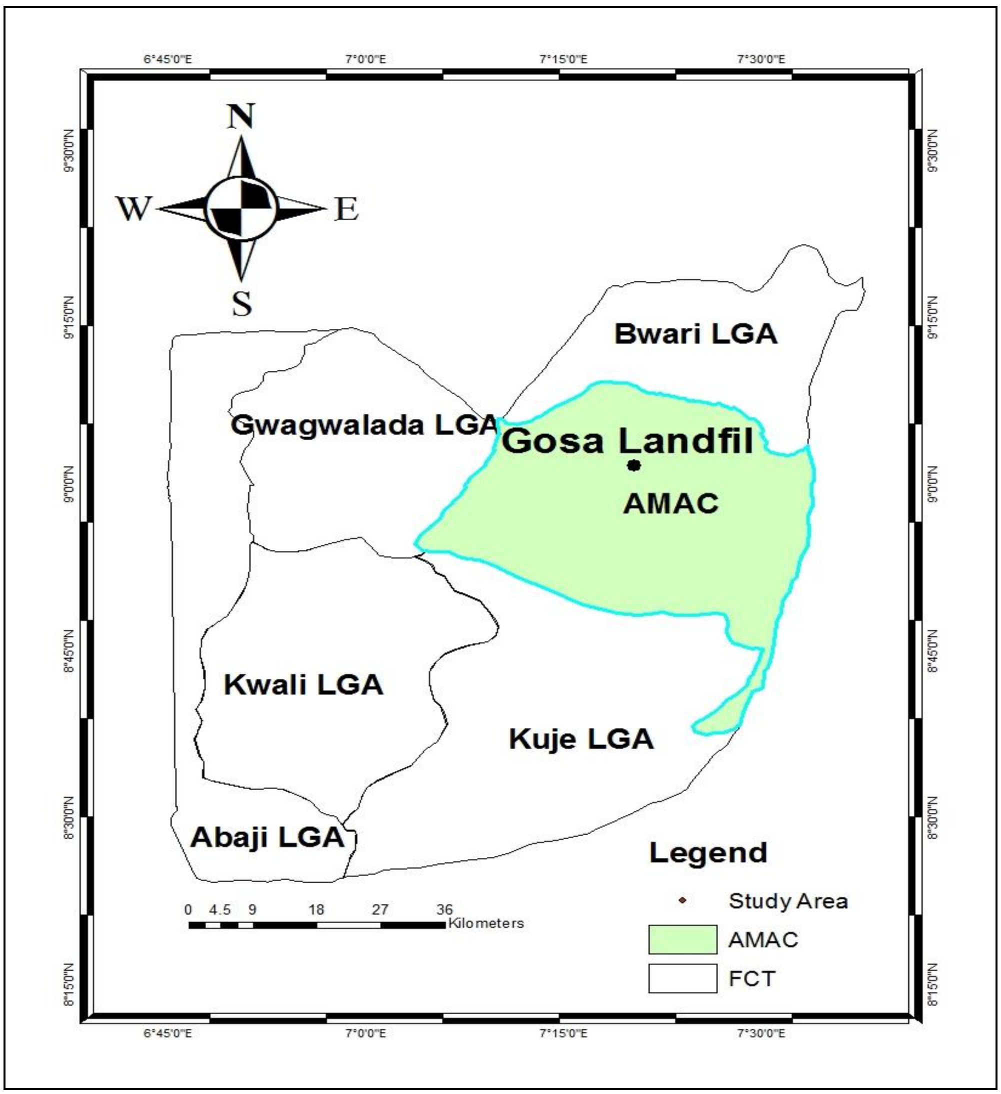

Fig 1: Federal Capital Territory showing of the Study Area
Source: UniAbuja Gis Lab

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The Climate favours the production of a wide variety of crops, which include legumes (groundnuts, soyabean, lima bean, bambara nut and pigeon pea), cereals (maize, millet, sorghum and rice), solanaceous crops (peppers, tomato, garden eggs and ginger), tree crops (guava, cashew, mango, orange and paw-paw), and root and tuber crops (yam, sweet potatoes, cocoyam and cassava). For livestock production, the animals that are mostly kept are swine, goats, sheep and poultry. Hunting and bee-keeping are also practiced (CIFIIIP, 2013). The area is mainly occupied by small holding rain fed and irrigation farmers who grow yam, rice, melon seed, cocoyam, cassava, pepper, tomato, okra rice, onion, garden eggs, spinach, beniseed and millet among others (CIFIIIP, 2013).

➢ *Sampling Procedure*

Random sampling was used to select wells and boreholes in the study area. Three boreholes and three wells were selected from three communities (Hulumi, Jiyita and Paipe) surrounding the landfill while one borehole and one well were selected within the landfill, making a total of eight (8) water samples in the study area.

The water samples were collected in a plastic bottle of approximately 1.5 litre capacity. The bottles were rinsed three times with the sample water. The containers were filled to capacity and caps screwed tightly to eliminate bubbles. Masking tape was used to close any gap between the bottle and the cap. The bottles were fully labeled with location, date, operating condition of the source and the number of the sample. Then the sample was taken to Abuja Environmental Protection Board (AEPB) Laboratory for chemical, physical, heavy metals and bacteriological analyses. Analyses were conducted on the samples by AEPB officials in attendance and results will be obtained for interpretation.

Plate 1: Water Sample Collection in the Dumpsite

III. RESULTS AND DISCUSSION

➢ *Physical and Chemical Characteristics of Water in the Study Area*

Table 1 shows that well in jiyita and paipe recorded the minimum value of temperature of 32.2^0c while the dumpsite has the highest recorded value of temperature of 32.9^0c. Boreholes in the dumpsite and Hulimi community have the minimum value of temperature of 32.3^0c while Paipe community recorded the highest value of 32.8^0c. The value of temperature of water samples fall within the Federal Ministry of Environment Standard of 40^0c.

The result of the value of pH of water sample taking in well in dumpsite and paipe recorded the minimum pH value of 6.4 while Jiyita community have the highest recorded pH value of 7.2. Boreholes in jiyita and paipe community have the minimum pH value of 6.4, while hulumi community and dumpsite recorded the highest value of 6.8. The temperature value of water samples falls within the Federal Ministry of Environment Standard of 6-9.

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The well in jiyita community recorded the minimum value of dissolve oxygen of 4.08mg/l while the dumpsite has the highest recorded value of dissolve oxygen of 7.51mg/l. Boreholes in the dumpsite have the minimum value of dissolved oxygen of 3.09mg/l while hulumi and jiyita community recorded the highest value of 7.82mg/l. The value of dissolve oxygen of all water samples fall within the Federal Ministry of Environment Standard of 7.5mg/l except the value recorded in the borehole of hulumi and jiyita community.

The well in hulumi community recorded the minimum value of conductivity of 119µS/cm while the jiyita community has the highest recorded value of conductivity of 368µS/cm. Boreholes in the jiyita have the minimum conductivty of 173µS/cm while dumpsite recorded the highest value of 742µS/cm. The value of conductivity of all water samples fall within the Federal Ministry of Environment Standard of 1000µS/cm.

The value on table 1 further revealed that well in hulumi community recorded the minimum value of total dissolve solid of 59.5mg/l while the jiyita community has the highest recorded value of total dissolve solid of 184mg/l. Boreholes in the jiyita have the minimum value of 87mg/l while dumpsite recorded the highest value of 372mg/l. The value of total dissolve solid of all water samples fall within the Federal Ministry of Environment Standard of 2000mg/l.

The result revealed that well in hulumi community recorded the minimum value of total hardness of 68.34mg/l while the dumpsite has the highest recorded value of total hardness of 102.72mg/l. Boreholes in jiyita community have the minimum value of 51.36mg/l while dumpsite recorded the highest value of 136.96mg/l. The value of total hardness of all water samples fall within the Federal Ministry of Environment Standard of 200mg/l.

well in dumpsite recorded the minimum value of 10mg/l of total alkalinity while the hulumi and jiyita community has the highest recorded value of 15mg/l. Boreholes in the three communities have the minimum value of 10mg/l while dumpsite recorded the highest value of 18mg/l. The value of total alkalinity of all water samples fall within the Federal Ministry of Environment Standard of 100mg/l.

well in three communities recorded the minimum value of 17.12mg/l of magnesium hardness while the dumpsite has the highest recorded value of 34.24mg/l. Boreholes in jiyita and paipe community have the minimum value of 17.12mg/l while dumpsite and Hulumi community recorded the highest value of 34.24mg/l. The value of Magnesium hardness of all water samples fall within the Federal Ministry of Environment Standard of 50mg/l.

well in hulumi community recorded the minimum value of 34.24mg/l of calcium hardness while the dumpsite has the highest recorded value of 68.48mg/l. Boreholes in jiyita community have the minimum value of 34.42mg/l while dumpsite recorded the highest value of 102.72mg/l. The value of calcium hardness of all water samples fall within the Federal Ministry of Environment Standard of 150mg/l.

well in paipe community recorded the minimum value of 0.11mg/l of total chlorine while the dumpsite has the highest recorded value of 5.04mg/l. Boreholes in jiyita community have the minimum value of 0.218mg/l while dumpsite recorded the highest value of 2.19mg/l. The value of total chlorine of all water samples are above the Federal Ministry of Environment Standard of 0.2mg/l.

well in hulumi community recorded the minimum value of sulphate of 6.8mg/l while the dumpsite has the highest recorded value of 36.9mg/l. Boreholes in paipe community have the minimum value of 1mg/l while dumpsite recorded the highest value of 27.1mg/l. The value of sulphate of all water samples fall within the Federal Ministry of Environment Standard of 500mg/l.

well in hulumi community recorded the minimum value of chloride of 22mg/l while the dumpsite has the highest recorded value of 130mg/l. Boreholes in hulumi community have the minimum value of 17mg/l while dumpsite recorded the highest value of 97mg/l. The value of chloride of all water samples fall within the Federal Ministry of Environment Standard of 600mg/l.

well in hulumi community recorded the minimum value of phosphate of 0.9mg/l while the dumpsite has the highest recorded value of 9. Boreholes in hulumi community have the minimum value of 0.95mg/l while dumpsite recorded the highest value of 6.3mg/l. The value of phosphate of all water samples fall within the Federal Ministry of Environment Standard of 5.5mg/l except for the samples on dumpsite which are above the FME standard.

well in jiyita community recorded the minimum value of nitrate 9mg/l while the dumpsite has the highest recorded value of 47.4mg/l. Boreholes in paipe community have the minimum value of 12mg/l while dumpsite recorded the highest value of 21.8mg/l. The value of nitrate of all water samples fall within the Federal Ministry of Environment Standard of 20mg/l except for the samples on dumpsite which are above the FME standard.

well in paipe community recorded the minimum value of nitrite of 0.055mg/l while the dumpsite has the highest recorded value of 1.08mg/l. Borehole in hulumi community has the minimum value of 0.007mg/l while dumpsite recorded the highest value of 0.99mg/l. The value of nitrite of all water samples fall within the Federal Ministry of Environment Standard of 1mg/l except for the samples on the well of the dumpsite which is above the FME standard.

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well in paipe community recorded the minimum value of ammonia of 0.04mg/l while the dumpsite has the highest recorded value of 6. Boreholes in jiyita community have the minimum value of 0.04mg/l while dumpsite recorded the highest value of 6mg/l. The value of ammonia of all water samples fall within the Federal Ministry of Environment Standard of 10mg/l.

well in hulumi community recorded the minimum value of BOD of 19mg/l while the dumpsite and paipe community has the highest recorded value of 47mg/l. Boreholes in hulumi community have the minimum value of 23mg/l while jiyita community recorded the highest value of 47mg/l. The value of biochemical oxygen demand of all water samples are above the Federal Ministry of Environment Standard of 30mg/l except for the samples on hulumi community and well on paipe community which their values are below the set standard.

well in jiyita community recorded the minimum value of COD of 120mg/l while the dumpsite has the highest recorded value of 640mg/l. Boreholes in jiyita and paipe community have the minimum value of 140mg/l while dumpsite recorded the highest value of 640mg/l. The value of chemical oxygen demand of all water samples are above the Federal Ministry of Environment Standard of 80mg/l.

Table 1: Physical and Chemical Characteristics of Water in the Study Area

S/N	PARAMETERS	HULUMI VILLAGE WELL	HULUMI VILLAGE BOREHOLE	DUMPSITE GOSA WELL	DUMPSITE GOSA BOREHOLE	JINITA VILLAGE BOREHOLE	JINITA VILLAGE WELL	PAIPE VILLAGE WELL	PAIPE VILLAGE BOREHOLE
A PHYSICAL TEST									
1.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
2	Temperature(°C)	32.8	32.3	32.9	32.3	32.7	33.2	33.2	32.8
3	pH	6.8	6.8	6.4	6.8	6.4	7.2	6.4	6.4
4	Dissolve Oxygen(mg/l)	5.71	7.82	7.51	3.09	7.82	4.08	7.44	7.57
5	Conductivity(μS/cm)	119	221	288	743	173	368	215	269
6	Total dissolved solids(mg/l)	59.5	110.8	144	372	87	184	107.5	135
B CHEMICAL TEST									
7	Total Hardness(mg/l)	68.34	102.72	102.72	136.96	51.36	68.42	68.48	85.6
8	Total alkalinity(mg/l)	15	10	10	18	10	15	14	10
9	Magnesium Hardness (mg/l)	17.12	34.24	34.24	34.24	17.12	17.12	17.12	17.12
10	Calcium Hardness (mg/l)	34.24	68.48	68.48	102.72	34.24	51.36	51.36	68.48
11	Total Chlorine(mg/l)	0.703	0.218	5.04	2.19	0.653	0.831	0.11	0.596
12	Sulphate (mg/l)	6.8	7.5	36.9	27.1	15.1	8.2	100	1.0
	Chloride (mg/l)	22	17	130	97	33	68	34	68
13	Phosphate (mg/l)	0.9	0.95	9.0	6.3	2.9	3	3.05	3.0
14	Nitrate as Nitrogen(mg/l)	15	13	47.4	21.8	12.0	9.0	10.0	9.0
15	Nitrite as Nitrogen (mg/l)	0.605	0.007	1.08	0.99	0.056	0.204	0.055	0.204
16	Ammonia as Nitrogen	0.5	0.4	6.0	6.0	0.04	0.05	0.04	0.05

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17	Biochemical Oxygen Demand(mg/l)	23	19	39	47	34	47	28	47
18	Chemical Oxygen Demand(mg/l)	160	200	640	640	120	140	140	140

Source: Fieldwork, 2019.

- *Heavy Metal Properties of Water Samples in The Study Area*

The result in table 2 revealed that well in hulumi community recorded the minimum value of chromium of 0.006mg/l while the jiyita community has the highest recorded value of 0.82mg/l. Boreholes in hulumi community have the minimum value of 0.006mg/l while paipe community recorded the highest value of 0.82mg/l. The value of chromium of all water samples fall within the Federal Ministry of Environment Standard of <1mg/l.

The result shows that well in hulumi and jiyita community recorded the minimum value of cadmium of 0.003mg/l while the paipe community has the highest recorded value of 0.006mg/l. Boreholes in dumpsite have the minimum value of 0.001mg/l while jiyita community recorded the highest value of 0.015mg/l. The value of cadmium of all water samples fall within the Federal Ministry of Environment Standard of <1mg/l.

The result in table 2 revealed that well in jiyita community recorded the minimum value of copper of 0.25mg/l while the dumpsite has the highest recorded value of 2.83mg/l. Boreholes in paipe community have the minimum value of 0.25mg/l while hulumi community recorded the highest value of 1.55mg/l. The value of copper of water samples in paipe and jiyita fall within the Federal Ministry of Environment Standard of <1mg/l while the value gotten from dumpsite and hulumi community is higher than the set standard.

The result also show that well in paipe community recorded the minimum value of total iron of 0.09mg/l while the dumpsite has the highest recorded value of total iron of 2.7mg/l. Boreholes in hulumi community have the minimum value of total iron of 0.8mg/l while dumpsite recorded the highest value of 1.68mg/l. The value of total iron of water samples in the three communities fall within the Federal Ministry of Environment Standard of 1.5mg/l while the value gotten from dumpsite is higher than the set standard.

well in hulumi community recorded the minimum value of manganese of 0.02mg/l while the dumpsite has the highest recorded value of mamganese of 0.16mg/l. Boreholes in jiyita community have the minimum value of manganese of 0.006 while dumpsite recorded the highest value of 0.18mg/l. The values of manganese of all the water samples fall within the Federal Ministry of Environment Standard of 0.2mg/l.

well in paipe community recorded the minimum value of zinc of 0.06mg/l while the dumpsite has the highest recorded value of zinc of 2.15mg/l. Boreholes in hulumi community have the minimum value of zinc of 0.24mg/l while dumpsite recorded the highest value of 1.19mg/l. The values of zinc of all the water samples fall within the Federal Ministry of Environment Standard of 3mg/l.

well in jiyita community recorded the minimum value of silicon of 0.5mg/l while the dumpsite has the highest recorded value of silicon of 35mg/l. Boreholes in paipe community have the minimum value of silicon of 0.5mg/l while dumpsite recorded the highest value of 20mg/l. The FME standard was not detected for silicon.

Table 2 further show that well in jiyita community recorded the minimum value of lead of 0.007mg/l while the dumpsite has the highest recorded value of lead of 1.99mg/l. Boreholes in paipe and jiyita community have the minimum value of lead of 0.007mg/l while dumpsite recorded the highest value of 1.08mg/l. The values of lead of the water samples of the three communities fall within the Federal Ministry of Environment Standard of 0.1mg/l while values recorded on the dumpsite is higher than the set standard by FME.

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Table 2: Heavy Metal Properties of Water Samples in the Study Area

S/N	PARAMETERS	HULUMI VILLAGE WELL	HULUMI VILLAGE BOREHOLE	DUMPSITE GOSA WELL	DUMPSITE GOSA BOREHOLE	JINITA VILLAGE BOREHOLE	JINITA VILLAGE WELL	PAIPE VILLAGE WELL	PAIPE VILLAGE BOREHOLE
HEAVY METALS									
1	Chromium(mg/l)	0.010	0.006	0.59	0.45	0.20	0.82	0.008	0.82
2	Cadmium(mg/l)	0.003	0.003	0.005	0.001	0.015	0.003	0.006	0.003
3	Copper(mg/l)	1.08	1.55	2.83	1.30	0.63	0.25	0.53	0.25
4	Iron Total(mg/l)	0.4	0.8	2.70	1.68	1.0	1.25	0.09	1.25
5	Manganese (mg/l)	0.02	0.025	0.16	0.18	0.006	0.02	0.03	0.02
6	Zinc (mg/l)	0.13	0.24	2.15	1.19	0.39	1.06	0.06	1.06
7	Silicon (mg/l)	10.2	10.0	35.0	20.0	ND	0.5	0.6	0.5
8	Lead(mg/l)	0.008	0.008	1.99	1.08	0.007	0.007	0.018	0.007

- *Bacteriological Content of the Sample Water*

The result in table 3 show that well in hulumi community recorded the minimum value of totalcoliform count of 920MPN/mL while the dumpsite, jiyita and paipe has the highest recorded value of 1600MPN/mL, boreholes in hulumi community have the minimum value of 540MPN/mL while dumpsite recorded the highest value of 1600MPN/mL. For fecal coliform count, well in hulumi community recorded the minimum value of 156CFU/mL while the dumpsite has the highest recorded value of 690CFU/mL, boreholes in hulumi community have the minimum value of 120CFU/mL while dumpsite recorded the highest value of 490CFU/mL. The values of total coliform count of all water samples of the study are above the Federal Ministry of Environment Standard of 1.8 MPN/mL while for fecal coliform count, samples on dumpsite, paipe and jiyita are above the FME standard of 200 CFU/mL while the values on hulumi communities are below the FME standard of 200 CFU/mL.

Table 3: Bacteriological Content of the Sample Water

S/N	PARAMETERS	HULUMI VILLAGE WELL	HULUMI VILLAGE BOREHOLE	DUMPSITE GOSA WELL	DUMPSITE GOSA BOREHOLE	JINITA VILLAGE BOREHOLE	JINITA VILLAGE WELL	PAIPE VILLAGE WELL	PAIPE VILLAGE BOREHOLE
1	Total Coliform Count(MPN/mL)	920	540	1600	1600	920	1600	1600	540
2	Fecal Coliform Count (CFU/mL)	1.56×10^2	1.20×10^2	6.9×10^2	4.90×10^2	3.0×10^2	4.8×10^2	3.1×10^2	4.8×10^2
3	E-coli	+	+	+	+	+	+	+	+
4	Salmonella)	+	+	+	+	+	+	+	+
5	Shigella(CFU/100 ml)	+	+	+	+	+	+	+	+
6	Enterobacter	+	+	+	+	+	+	+	+

Source: Field Work, 2019

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IV. DISCUSSION OF RESULT

The finding shows that the value of temperature, pH, conductivity, total dissolve solid, total hardness, total alkalinity, magnesium hardness, calcium hardness, sulphate, chloride, cadmium, ammonia, chromium manganese and zinc of all study site sample water are within the safety limit set by federal ministry of environment, also values of total chlorine, phosphate, nitrate, nitrite, total iron and lead of the three communities (paipe, hulumi and paipe) are below the set standard of FME safety limit except the values on the dumpsite which is higher than the set safety limit by FME. In other words, values of total chlorine, phosphate, nitrate, nitrite, total iron and lead recorded on the dumpsite is higher than the set safety limit by FME. This implies that water used on the landfill is polluted. The result show elevates level of nitrate, this could be as a result of shallow, poorly constructed well in the study area. high value of lead and chromium can be attributed to metal and electronics dumped at the landfill.

High value of lead on the dumpsite can cause a variety of adverse health effects when people are exposed to it for relatively short periods. These effects may include interference with red blood-cell chemistry, delays in normal physical and mental development in babies and young children, deficits in attention span, hearing and learning abilities of children and increases in the blood pressure of adults. Long-term exposure to lead has the potential to cause stroke, kidney disease and cancer (USEPA, 2012). Chromium occurs naturally in the environment from the erosion of natural chromium deposit (EPA, 2008). Effect of high chromium includes skin irritation or ulceration, allergic contact, dermatitis, occupational asthma, nasal irritation and ulceration, people living on the dumpsite are highly at risk of this effect, as the result of chromium obtain on the dumpsite is very high. These effects may include interference with red blood-cell chemistry, delays in normal physical and mental development in babies and young children, deficits in attention span, hearing and learning abilities of children and increases in the blood pressure of adults.

High level of Nitrate in drinking water on the dumpsite can also be an indicator of overall water quality. Elevated nitrate levels may suggest the possible presence of other contaminants such as disease-causing organisms, pesticides, or other inorganic and organic compounds that could cause health problems. Nitrates are essential source of nitrogen for plants. Human and animal wastes can contribute to nitrate contamination of ground water. Agricultural practices have been linked to elevated levels of nitrate in drinking water, although any well can become contaminated by nitrates, shallow, poorly constructed, or improperly located wells are more susceptible to contamination.

More also the value of dissolve oxygen of the borehole of the three communities within the dumpsite are higher than the FME safety limit, value of Biochemical Oxygen Demand (BOD) on dumpsite and Jiyita community is above the safety limit, values of Chemical Oxygen Demand (COD) and total colifom count of all sampling point are above the safety limit set by FME, values of fecal coliform count on dumpsite, paipe and jiyita are above the FME standard, value of copper in Hulumi community and dumpsite are above the safety limit and values of silicon on Hulumi community and the dumpsite are above the safety limit set by FME.

This shows that the activity on the dumpsite also has effect on the neighboring surrounding as water percolate under the ground, this water flow into wells and underground water close to the dumpsite. people living in this three settlement are prone to the negative effect of BOD, COD, copper and silicon. Copper, this is a natural occurring metal found in rock, soil, water and sediment, get into water through household plumbing, faucets and water mixtures (WHO, 2006). Only a small amount of copper is essential for good health. Exposure to high doses can cause health problems, short term exposure can cause gastrointestinal distress while long term exposure can cause anemia and disrupt liver and kidney functions. Furthermore the high value of total coliform count and fecal count can be traced to the disintegration of solid waste to liquid waste which has percolate down into the underground layer, Total Coliform are bacteria that are found in the soil, in water and human or animal waste; they make human sick if ingested while Faecal Coliform in water may not be directly harmful and does not indicate the presence of faeces but can be harmful to the environment as its can reduce dissolved oxygen levels if discharged into rivers or waterways. Some water borne pathogens diseases that may coincide with faecal coliform contamination include ear infections, dysentery, typhoid fever viral and bacterial gastro enteritis and hepatitis A. this is are all serious health challenge that the resident of the study area is in danger of.

V. CONCLUSION AND RECOMMENDATION

Access to safe water is essential to health, a basic human right and a component of effective policy for health protection. The importance of water, sanitation and hygiene for health development has been reflected in the outcomes of a series of international policy forums which include health-oriented conferences such as the 1977 World Water Conference in Mar Del Plata, Argentina, that launched the water supply and sanitation decade of 1981-1990, the International Conference on Primary Health Care, Kazakhstan (former Soviet Union) in 1978; as well as the Millennium Development Goals adopted by the General Assembly of the United Nations (UN) in 2000.

Abuja Municipal area council, like any other growing area council in Nigeria, has witnessed dramatic increase in human population over the past decades, which exerted pressure on the nature of waste generated and cause increase

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in number of waste dump at Gosa landfill this has cause naturally fragility on the surface and ground water sources use for domestic purposes within the dumpsite. It is thus, unexpected that the quality of potable water in the area will remain unchanged. The study shows that the activity of the landfill in terms of waste dump has cause increase in the bio-chemical and heavy metal contain of the water where most value of the observe biochemical and heavy metal properties of the collected water samples are higher than the safety limit set by federal ministry of environment. The va,ue of Total chlorine, phosphate, nitrate, nitrite, biochemical oxygen demand, chemical oxygen demand, coper, total iron silicon, lead, total colifom count and fecal count observed on the landfill is higher than safety limit set by FME. Increase in this entire chemical above can pose a serious threat to the health of the resident of the study area most especially lead.

While the study mad efforts to further add to the growing body of knowledge on water quality studies, it is suggested that similar studies be carried out periodically in all other landfills within FCT, as a starting point towards achieving the MDG number 7 which is concerned with ensuring that safe water is accessible to at least over 100 million slums dwellers by 2015. It is also suggested that the key area of water quality (such as anthropogenic and natural factors responsible for concentration of contaminants in water, measures for treating polluted water sources, etc) should also be investigated in this study area.

Based on the findings, the study further recommends the following:

- Construction of boreholes and wells close to septic tanks, latrines and gutters should be prohibited by the respective Government regulatory agencies; in other words, the scavengers living within the dumpsite should be provided with water from outside the landfill through daily distribution of water from tanks.
- The Ministry should engage in serious enlightenment campaign to educate the populace on water pollutants, effects and precautions; so has to discourage the scavengers from further drinking of water within the landfill.
- Should in case the residents of the landfill insist in drinking water from wells within the land fill there should be daily purification of this water through biological or chemical processes.
- There should be a periodic monitoring and assessment of water quality in Gosa landfill to ascertain status at every given time;

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