

1 **An Overview of Onsite Residential Sewage Disposal**
2 **and the Implications on Underground Water Supply and**
3 **Health in Nigeria.**

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8 **Abstract.** A residential housing is normally designed to serve the immediate
9 need of human activities. Usually, provision for collection and disposal of sewage
10 is a priority to enhance a healthy living environment. The millennium
11 development goal on human health remains unrealistic in many developing
12 countries due to poor disposal of sewage. Using a combination of primary and
13 secondary data this study presents an overview of onsite sewage disposal and its
14 impact on underground water and health issues in Nigeria. Findings show that
15 onsite septic tank is the main method of sewage disposal. An average of 5 metres
16 was observed between the shallow dug well and septic tank. Hence, the
17 underground water is highly susceptible to contamination but remains the
18 primary source of domestic water supply. Reported cases of cholera traceable to
19 fecal contamination of underground water remain very high. This paper argues
20 for the involvement of professional in the building industry to present a proposal
21 for a central sewage system particularly where the risk of infiltration of sewage
22 into the water body is high.

23 **Keywords:** Housing, Sewage, Septic Tank, Disposal, Health, Policy

24 **1 Introduction**

25 Man's interaction on land constantly produce waste which impinge negatively on the
26 ecological balance of the environment. It constitutes issues which are often neglected
27 until a lapse in the care for environment [1]. Hence, conscious efforts are made to
28 evolve safe and sustainable method for collection and disposal of Municipal Solid
29 Waste (MSW) from houses. Without this, the millennium development goal which
30 finds expression reduction in mortality rate, infectious diseases and sustainable
31 environment may not be realized in many developing countries due to unsafe disposal
32 of MSW. According to [2], the rate of generation MSW is expected to increase to 2.2
33 billion tonnes per year by 2025 worldwide. However, the collection and disposing are
34 still challenging in the third world countries. The narrative in the developed world is
35 quite different. Emerging technologies have produced different bye-products such as
36 heat, electricity, compost and bio-fuels from MSW (see [3], [4] and [5]. Generally,
37 MSW is a pool of various solid wastes by towns and cities from different types of

38 household activities [6]. However, this study is concern with sewage, it is often
39 generated from several sources where variable human activities occur. Several studies
40 indicate that (55–80%), of the municipal solid waste from developing countries are
41 generated from households [7]. Hence, this study draws context from the sewage from
42 the residential home to examine the impact of onsite septic tank on underground water
43 and health. In the developing world, the disposal of sewage is popularly done via an
44 onsite septic tank. This practice had been largely de-emphasized in the developed due
45 to the danger it portends to the human environment. According to [8], the importance
46 of individual household sewage disposal systems in American sewerage practice is
47 rarely recognized since the mid 20th century. It was estimated that, as of 1945, only
48 17,000,000 persons were served by individual home sewage disposal systems,
49 compared to 75,000,000 persons served by public sewer systems. According to [9],
50 about 20% of the population use on-site wastewater treatment in France. In the United
51 States, [10], reported that about one in four households in the United States uses a septic
52 tank for wastewater disposal. Approximately, 500,000 rural households depend on on-
53 site wastewater treatment systems for their effluent disposal in Ireland [11]. In Nigeria,
54 the popular means is the onsite septic tank and open defecation in the rural areas. The
55 source of concern is the proximity of the septic tanks to shallow dug well.

56 **2 Disposal of Municipal Solid Waste and Sewage**

57 Generally, there are two main ways of disposing sewage in the residential environment,
58 namely on-site septic tank and central sewage system. While the onsite septic tank is
59 not popular, it is not entirely bad, but its application is quite limited in the developed
60 world cities. According to [12], many homeowners rely on onsite sewage systems
61 (septic tanks and absorption fields). Every year, many of these systems fail with a costly
62 consequence. This is simply because On-site disposal systems cannot be installed in all
63 situations. For example, they cannot be installed: in areas that flood regularly, areas
64 that have a high water table (that is, where the underground water is close to the
65 surface), where the amount of wastewater to be disposed of is large near to drinking
66 water supplies. Subsurface pathways of sewage are increasingly recognized as a
67 problem for underground water (See [13] and [14]). According to [15], on site septic
68 tank soil absorption system treating sewage has led to contamination of groundwaters
69 with enteric viruses and other pathogens and outbreak of water borne diseases. This is
70 substantiated by some empirical studies on the impact of onsite septic tank in homes.
71 For instance [11] noted that one of the key threats to groundwater and surface water
72 quality in Ireland is the impact of poorly designed, constructed or maintained on-site
73 wastewater treatment systems. The study quantifies the impact of existing sites on water
74 quality. Six existing sites consisting of a traditional septic tank and soakaway system,
75 located in various ranges of subsoil permeabilities were identified and monitored to
76 determine how well they function under varying subsoil and weather conditions. The
77 preliminary results of the chemical and microbiological pollutant examination show
78 fecal contamination in the nearby groundwater. [16] noted that there are currently
79 several on-site wastewater treatment systems (on-site systems) in peri-urban and rural

80 areas in the south-east of South Australia. The study found that on-site systems and the
81 subsequent localised discharge of treated effluent can lead to public health and
82 environmental concerns through direct contact with effluent and contamination of
83 groundwater resources.

84 While the management of sewage and MSW is still a concern, turning it to wealth
85 and useful product for power generation is gaining ground in the advanced nations. For
86 instance, [17] found that turning waste into energy could be key to a circular economy,
87 enabling the value of products, materials and resources to be maintained on the market
88 for as long as possible, minimizing waste and resource use. As the circular economy is
89 at the top of the EU agenda, member States of the EU are moving away from the old-
90 fashioned disposal of waste to a more intelligent waste treatment encompassing the
91 circular economy approach in their waste policies. [4] assesses at the African level, the
92 role of waste in providing energy to citizens. The study found that energy recovery from
93 waste can play a role in minimizing the impact of MSW on the environment with the
94 additional benefit of providing a local source of energy. There is a growing
95 understanding, at global level, about the negative impacts that waste can have on the
96 local environment (air, water, land) and human health etc.

97 **3 Domestic Water Supply in Residential Housing in Nigeria**

98 Water supply and sanitation provision has been at the core of international attention
99 reflected in various international directives and declarations over the decades. [18]
100 assesses the Nigerian policy trend and practices in relation to water supply and
101 sanitation coverage over the past ten decades. The review observed that the Nigerian
102 water and sanitation policy environment is characterized by too many short-lived
103 policies without corresponding action. According to [19], Nigeria is targeting 100%
104 access to basic water supply and sanitation services by 2030. To achieve this, the
105 government requires US\$2.74billion yearly however the financing gap stands at
106 \$106million per annum. [20] joint monitoring programme reveals that accessibility to
107 safe water delivery in Nigeria by public mains on premises is low and yearly declining.
108 Statistics reveal that 32%, 20% and 11% were recorded between 1990, 2000 and 2008
109 respectively. The implication of this is that most urban dwellers will have to depend on
110 accessibility to improved water via underground source in their premises. This led
111 credence to the fact that many Nigerians depend on private arrangement via shallow
112 well which is normally located in a proximate location to septic tank. Recently, cholera
113 epidemic engulfed 14 states and over 700 lives were lost. It is pertinent to state that
114 most of the cholera cases were recorded in informal residential districts or slum there
115 were no development control measure to restore sanity in on-site disposal of sewage.
116 [21] discovered that basic water, hygienic improvement could eliminate 3% to 4% of
117 global region diseases. He stressed that the commonest water and sanitation related
118 diseases (Cholera, arsenicosis, flurosis, guinea worm, intestinal worms, schistosmiasis,
119 typhoid and trachoma can be potentially avoided with the provision of improved water
120 supply and sanitation. Furthermore, people living with HIV/AIDS can more readily

121 avoid opportunistic infections associated with the disease if they have no access to
122 improved water supply and sanitation.

123 **4 Research Method**

124 This study employs a combination of desk research and observation. Dominantly, it
125 involves the collection of data from existing resources. Also, personal observation was
126 employed to collect primary data concerning the proximity of the septic tank to
127 underground water sources.

128 **5 Findings and Discussion.**

129 Onsite septic tank is the primary method of disposing sewage in Nigeria at large. It is
130 usually located within an average of 5 meters to shallow well which is the major source
131 of domestic water supply. This portends grave danger to peoples' health as corroborated
132 by a study carried by [22] on assessment of bacteria pollution of shallow well water in
133 Abeokuta. Interview conducted reveal high turbidity and offensive odour particularly
134 during rainy seasons which indicate seepage and leaching of fecal coliform into
135 underground water source. Unfortunately, the commonest source of water for domestic
136 uses is a shallow dug well. For example, in Ondo state Table 1 shows that 44.37%
137 collect their water from a shallow well. The implication is that 44.37% in the state are
138 exposed to water borne diseases from underground water pollution due to nearby onsite
139 septic tank in homes. Also, 9.98% access water via borehole while only 1.82% used
140 water from pipe borne water in dwelling houses. In addition, 2.24% depend on sachet
141 water which has led to alarming increase in the plastic waste threatening aquatic life in
142 Nigeria.

143 **Table 1: Sources of Water Supply in Ondo State.**

Sources of Water Supply	Frequency	Percentage (%)
Pipe-borne inside dwelling	13,908	1.82
Pipe-borne outside dwelling	24,210	3.17
Tanker Supply/ water vendor	12,675	1.66
Shallow dug Well	338,579	44.37
Borne hole	76,116	9.98
Rain Water	42,220	5.54
River/ Stream/ Spring	230,095	30.16
Dug out /Pound/lake	8,095	1.06
Sachet water	17,122	2.24
Total	763,020	100.00

144 Source: Calculated from National Population Census 2006.

145 Assessing the risk of onsite disposal of sewage, Table 2 shows that the risk of cholera
146 infection of water has not change significantly, although the death recorded has reduced
147 for the 37 years in which the data collected. The table shows that 22,931 cases of
148 cholera infection was reported in 1971 while 18,205 was reported 47 years after in

149 2018. This statistic exhibits a link with onsite location of septic tank in homes. This
 150 assertion is strengthened by Lagos State Ministry of Health 2017 confirmation on the
 151 death of two students of the Queens College who died of cholera infection. This was
 152 traced to the pollution of the underground water source by nearby onsite septic tank.
 153 This shows and confirm [23] findings. The study found that cholera, which was once
 154 common throughout the world, is now largely confine to developing countries where
 155 onsite septic tank is rife. This is also buttressed by [24] findings which reveal that 132
 156 121 cholera cases and 2420 deaths were reported to WHO globally in 2016. It noted
 157 that 54% of the cases occurred in Africa, 13% from Asia and 32% from Hispaniola.
 158 Notably, Cholera remains a major health issue primarily in developing countries with
 159 poor sanitation, sewage disposal and water supply.

160 **Table 2:** Nigeria Cholera Cases and Resulting deaths between 1971 and 2018.

Year	Reported cases	Recorded deaths
1971	22,931	2,945
1991	59,478	7,654
2001	2,050	80
2005	37,289	1,434
2008	5,140	247
2009	13,691	431
2010	41,787	1,716
2011	22,454	715
2018	18,205	235

161 Source: Nigerian Centre for Disease Control, World Health Organisation

162 Access to improved water and sanitation services in Nigeria are less than those seen
 163 in many other Sub-Saharan African countries. Fifty-seven million people in Nigeria
 164 continue to live without access to improved water [25]. As many as 130 million people
 165 do not meet the Millennium Development Goal (MDG) standards for sanitation. Even
 166 if the access to improve sanitation is higher, it does not reduce the negative health
 167 implications of disposing the sewage into onsite septic tank in homes. Although the
 168 mortality report from cholera cases has reduced, the reported cases of infection does
 169 is still high due to vulnerability of underground to fecal contamination from nearby onsite
 170 septic tank and open defecation (See Table 2). The implication of this is whopping sum
 171 of 455 billion naira (\$2 billion) spent on poor sanitation per annum.

172 **6 Conclusion**

173 Previous studies show that onsite septic tank is a method of sewage disposal, however
 174 its application is quite limited in the developed world where cases of cholera and other
 175 waterborne disease are low. What is clear from the existing studies is a link between,
 176 onsite sewage disposal, underground water supply contamination and water borne
 177 infection like cholera. With a primary reliance on onsite sewage disposal in homes

178 health issue resulting from cholera put a most people at risk of the disease in Nigeria.
 179 This risk may continue to increase until something is done to limit the use of onsite
 180 septic tank and direct sewage to a treatment plant where it could be converted to other
 181 useful by products. This study provides an overview of the possible impact of the
 182 onsite septic for sewage disposal in homes. Finding from this study reveal that the use
 183 of onsite septic tank has serious policy implications. Achieving a sustainable sewage
 184 disposal and improved underground water supply call for guidance in the wider
 185 application of onsite septic tank. Environmentally sound sewage disposal must go
 186 beyond the mere onsite disposal and access to improved sanitation. Also, government
 187 should embark on the construction central sewage system throughout the urban area to
 188 eliminate unhealthy use of onsite septic tank near shallow well in Nigeria. This paper
 189 argues for a position paper written by professionals in the building industry to the public
 190 authority for the construction of central sewage system. and restriction of onsite septic
 191 tank to all building site.

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