# Current Trend in Water Supply and Consumption, and Associated Health Implications ions in Port Harcourt, Nigeria.

**Isoteim Fubara-Manuel[1], George R. Otoko[2], and Raphael B. Jumbo[1].**

[1]Department of Agricultural and Environmental Engineering,
[2]Department of Civil Engineering,

Rivers State University of Science and Technology, Port Harcourt, Nigeria.

E-mail :fubara-manuel.isoteim@ust.edu.ng

**ABSTRACT**

*This paper briefly discussed potable water situation in Port Harcourt, Nigeria, from the 1950s, and then highlighted major factors preventing the implementation of water projects. Due to the inability of government to provide water, and the regulatory agency to monitor the quality of water, entrepreneurs are marketing all sorts of packaged water. Analysis of sachet water from 30 manufacturers showed that all the sachets had neither date of production nor expiry. Furthermore, 26.7% of the sachet water had E-coli ranging from 10 to 110 MPN/100ml, while 33.3% had total coliform ranging from 10 to 530 MPN/100ml. These values are outside those recommended by WHO. Records from Braithwaite Memorial Specialist Hospital between 2010 and 2014 revealed that the mortality rates, mainly among children, for gastroentritis, diarrhoea, and dysentry were 9.46, 4.62, and 11.59% respectively. It was therefore suggested that government should accept its social and moral responsibilities.*

**KEY WORDS:** Water supply, consumption, health problems, Port Harcourt, Nigeria.

## INTRODUCTION

The Millennium Development Goals have just ended. In that Report, produced in 2008, World leaders agreed to halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation. This is 2016, and it is obvious that the situation today in Nigeria is not better than that in 2000 when the decision was taken. For Nigeria, it has been a mission unaccomplished.

Port Harcourt is the only city in Rivers State, an oil-producing state in the Niger Delta region of Nigeria. Most developmental efforts have therefore been concentrated in Port Harcourt. The problem of potable water in Port Harcourt cannot, however, be extricated from that afflicting the whole of the Niger Delta region because Port Harcourt is a microcosm of the Niger Delta cities.

UNDP (2006) described the Niger Delta as a region that is richly endowed with water resources but paradoxically is host to communities with poor human development status, partly as a result of perennial lack of potable water and basic sanitation services. This is in spite of the fact that it also hosts huge deposits of oil and gas, the exploitation of which provides over ninety-five percent of the foreign exchange earnings of Nigeria. It must however be stated that the woes bedeviling the Niger Delta are as a result of the cumulative abandonment and neglect by governments at all levels.

Port Harcourt, as an oil city, has witnessed tremendous growth in population arising from rural-urban migration. The city has therefore grown at a phenomenal rate in physical size and population, with at least six slum settlements, resulting in a huge safe drinking water deficit. Efforts by successive governments to bridge the gap between supply and demand for this resource have not yielded the desired result. This is evidenced by the large number of women and children that roam the streets of Port Harcourt with buckets and jerry cans in search of potable water.

Today, water supply in Port Harcourt has become a free-for-all affair with no regulations. Private individuals and companies have taken advantage of government's inability to provide potable water by marketing all sorts of bottled and sachet water. Most bottled water, produced by multi-national companies such as Coca-cola and Nestle, conform to WHO drinking water standards. The main problem is with the sachet water, commonly called "pure water", produced by small business entrepreneurs, and consumed mainly

by the low-income group. The purity of this water has been a source of concern to the public. The main focus of this paper, therefore, is to highlight most of the factors contributing to the near-collapse of the water sector in Port Harcourt, and the attendant implications for health.

## HISTORICAL PERSPECTIVES OF WATER SUPPLY IN PORT HARCOURT

According to Akoko (1995), the population of Port Harcourt in 1952 was 79,634, and water supply was through hand dug wells, with water lifted by steam driven pumps. As at 1958, the supply was from two separate boreholes located at the Airport Works and in the Ministry of Works Yard in the north and South of Port Harcourt respectively. The total capacity was 43,000 $m^3$/day, thus giving a per capita consumption of 0.54 $m^3$/day

By 1963, the population of Port Harcourt had increased to 179,563, thus necessitating the establishment of two booster stations. Between 1963 and 1972, three additional pumping stations were established.Water supply in Port Harcourt started becoming problematic from the mid '80s. By 1992, the population of Port Harcourt had reached 406,738. Apart from the population growth, there was also an increase in economic activities, with most oil companies establishing their headquarters in Port Harcourt instead of moving to the new Federal Capital, Abuja. This created additional pressure on existing facilities. Studies have shown that in 1992, most of the public taps (standpipes) installed on the streets were no longer functioning (Ayotamuno, 2015). Thus, it had become obvious that the cost of pumping, treatment, and distribution of piped water had overwhelmed the Government. However, Government, in its bid to continue supplying water, introduced an "innovative" scheme called the Neighbourhood Water Scheme in 1992. Under this scheme, boreholes were sunk at strategic locations in the city and its environs. Each borehole, driven by a 1.5hp electric pump, also had provision for two overhead tanks and six wall taps (Figure 1). Inhabitants obtained untreated water free from these locations. The boreholes were operated from 7 am to 7 pm daily. Each had a design capacity of about 10 $m^3$/day. At the end of 1994, there were twenty-six schemes functioning. However, by 1998, the scheme had virtually collapsed mainly due to mismanagement.

As at 2015, Port Harcourt had four major pumping stations and four substations with total installed capacity of 104,400 $m^3$/day. If all the pumping stations were to work at full capacity, then the per capita consumption would be 0.08 $m^3$/day, based on a population of 1,382,592 according to the 2006 Nigerian census. It is worth mentioning that in the '50s and early '60s, house connections were only made in areas called "European Quarters", where the whites and a few highly placed Nigerians lived. However, every public tap was functioning.

## CURRENT SITUATION

When, in 1972, Landlords in Port Harcourt were instructed to install septic tank systems in their buildings, those, especially in the city centre, complied. However, as water became scarce due to government's inability to provide this commodity, Landlords resorted to drilling boreholes in their premises. Because of the small, fragmented nature of landholdings, boreholes were drilled in close proximity to septic tanks and soak-aways. For example, Isabu (2013) found out that many boreholes were drilled less than 9m from septic tanks in contrast to the recommended distance of 30m by WHO. No form of treatment is given to the borehole water.

Some landlords use it for personal consumption and/or commercial purposes. As Pickford (1981) rightly points out, without water there is no life. But bad water can be almost as harmful as no water – it too can result in disease and death. According to Napacho and Manyele (2010), improper management of water, especially treatment and disposal of solid and liquid wastes are the major contributors of urban area water pollution.

Government's inability to meet consumers' water demand gave rise to the booming sachet water business. This assertion is corroborated by Akunyili (2003), who stated that the inability of Government to consistently provide adequate water contributed to the proliferation of the so called 'pure water' manufacture in Nigeria. Numerous outlets are springing up all over Port Harcourt on a daily basis. The sachet water pack is very cheap and, when refrigerated, is enjoyed by consumers under the scotching humid tropical sun, thus creating a high demand by the majority low-income group. This development is not peculiar to Port Harcourt or Nigeria. It has become a West African problem as asserted by Stoler et al., (2012), who insist that despite scientific interest in microbiological quality of sachet water that dates back to at least the mid-1990s, there is still a striking paucity of research on the topic.

## HEALTH PROBLEMS

In 2015, sachet water from 30 different manufacturers were analysed by physical inspection of the sachet, and in the laboratory for the physico-chemical and microbiological properties of the liquid contents. Table 1 shows the result of the physical inspection of the sachet.

It can be seen that 86.7% of the sachets had no labels of the National Agency for Food Drug Administration and Control(NAFDAC), which is the regulatory agency, even though all the sachets had NAFDAC numbers. Furthermore, there was no date of manufacture on any of the sachet but 30% of the manufacturers indicated two months after production as the expiry date without date of production. This is unacceptable and cannot therefore be regarded as expiry date. Thus, no manufacturer had either date of production or date of expiry.

Table 2 presents the result of the physico-chemical and microbiological analysis of the sachet water. Although most of the parameters analysed conform with WHO(1971) standards, there were some sachet water that did not meet very critical parameters such as E-coliform and total coliform. The table shows that 26.7% of the sachet water investigated had E-coli ranging from 10 to 110 MPN/100 ml, while WHO recommended zero. For total coliform, WHO recommended between 0 and 2, but 33.3% of the sachet water had total coliform ranging from 10 to 530 MPN/100 ml. Consumption of such unwholesome water is bound to have devastating consequences.

Iyaye (2013) revealed that records collated from some medical facilities by the Rivers State Ministry of Health, Port Harcourt, indicated that between 2009 and 2012, there were 305 cases of cholera outbreak, with 23 deaths. There were also 1,074 cases of typhoid and paratyphoid, resulting in 12 deaths. Furthermore, 2,856 cases of amoebiasis were recorded, with a total of 128 deaths. Records from the Braithwaite Memorial Specialist Hospital (BMSH), Port Harcourt, between 2010 and 2014, are presented in Table 3. This table shows that for the five-year period between 2010 and 2014, the mortality rates for gastroenteritis, diarrhoea, and dysentery were 9.46, 4.62, and 11.59% respectively. The victims were mainly children. Although there is no direct link between these reported cases of water-borne diseases and the sachet water investigated, research findings have implicated sachet water in the spread of these diseases ( Edema et al., 2001; Okonko et al., 2008; Dada, 2009 ).

## SUGGESTIONS FOR IMPROVEMENT

For any water project to succeed, the government must show high sense of commitment by accepting the fact that it has both social and moral responsibilities in the provision of this facility. Akinyili (2003) asserts that packaged water especially the sachet (pure water) production is good poverty alleviation programme and should be encouraged, adding that it is an industry that has immense potential for job and income generation. Agreed. However, the health of consumers, not economy, should be most paramount.

It is now obvious that the National Agency for Food and Drug Administration (NAFDAC) whose statutory responsibilities include the regulation of sachet water production has been overwhelmed by the enormity of the problem. NAFDAC is no longer in a position to effectively control the production, and hence the quality of sachet water.

Potable water has always been a political issue in the Niger Delta. Ukiwo (2008) stated that without exception, the position papers of all ethnic and pan-delta groups have included demands for water. For example, in 1966, Isaac Adaka Boro, the leader of the Niger Delta Volunteer Service, revolted and declared the Niger Delta Republic. One of the grievances was water. Also, the Movement for the Survival of Ogoni People (MOSOP) stated in the Ogoni Bill of Rights that the Ogoni people have no pipe-borne water. Every government in the Niger Delta must therefore accept that it is inevitable and politically expedient to solve the water problem.

Funding of water projects is always a thorny issue. The various pumping stations in Port Harcourt are in derelict conditions. They need to be revamped. Funds must be provided to (1) purchase equipment and spares; (2) recruit and train personnel because old staff are retiring without replacement; (3) improve and expand facilities especially old and worn-out pipes that were installed in the '70s.

It is not only enough to inject funds into water projects. Proper management of funds has always been the bane of most central governments in developing economies. This brings to the fore the vexed question of private participation. Although many arguments have been made for and against private involvement, the current emphasis is on Public Private Partnership (PPP). It is widely acknowledged that the private sector is more efficient than the public sector. Government must therefore be encouraged to induce private entrepreneurs to participate in the water sector.

Another important aspect is public enlightenment. Consumers must be made to understand that the provision of water services costs money, and that they should be prepared to pay for such services. This will take a lot of effort because of years of apathy but if consumers observe that water has started flowing, they will make the necessary sacrifice to keep the project going. After all, they spend money on a daily basis for sachet water whose quality cannot be guaranteed.

It has been estimated that in Nigeria, over two-thirds of the diseases affecting the people and in particular the under-five age group can be attributed to poor water supply and unsanitary conditions (Agberemi, 2003). Government cannot, therefore, at this point, throw in the towel in the fight against water-borne diseases.

**REFERENCES**

Agberemi, O.Z.( 2003). Managing water supply and sanitation projects in Nigeria. Paper presented at the 29th WEDC International Conference, Abuja Nigeria.

Akoko, A. I.( 1995). Problems of water supply in Part Harcourt. B.Tech. dissertation, Department of Agricultural and Environmental Engineering, Rivers State University of Science and Technology, Port Harcourt, Nigeria.

Akunyili, N.D. (2003). The role of "pure water" and bottled water manufacturers in Nigeria. Paper presented at the 29th WEDC International Conference, Abuja, Nigeria.

Ayotamuno, M.J. (2015). Engineering and management of soil, water, and wastes. 31st inaugural lecture, Rivers State University of Science and Technology, Port Harcourt, Nigeria.

Isabu, C. M. (2013). The effect of distance between septic tanks and boreholes on water quality in Port Harcourt metropolis. B. Tech dissertation, Department of Agricultural and Environmental Engineering, RiversState University of Science and Technology, Port Harcourt, Nigeria.

Dada, A.C. (2009). Sachet water phenomenon in Nigeria: assessment of the potential health impacts. African Journal of Microbiology Research 3, 15-21.

Edema, M.O.,Amemu, A.M., and Fapetu, O.M. (2002). Microbiology and physiological analysis of different sources of drinking water in Abeokuta, Nigeria.J. of Microbiology, 15(1): 57-61.

Iyaye, I. (2013). Investigation of groundwater quality in Rivers State, Nigeria: A case study of Port Harcourt metropolis. B.Tech. dissertation, Department of Agricultural and Environmental Engineering, Rivers State University of Science and Technology Port Harcourt, Nigeria.

Napocho, Z.A. and Manyele, S.V. (2010). Quality assessment of drinking water in Temeke District (part II). Characterization of chemical parameters. African Journal of Environmental Science and Technology, 14(11): 775-789.

Okonko, I.O., Adeoye, O.D., Ogunusi, T.A., Fajobi, E.A. and Shittu, O.B.( 2008). Microbiological and physiochemical analysis of different water samples used for domestic purposes in Abeokuta and Ojota, Lagos State, Nigeria. Afr. J. Biotchnol. 7(3): 617-621.

Pickford, J. (1981). Criteria for excreta disposal. Staff paper, WEDC, Department of Civil Engineering, LoughboroughUniversity of Technology, England.

Stoler, J., Weeks, R.J., and Fink, G.(2012). Sachet drinking water in Ghana's Accra-Tema metropolitan area: Past, present, and future. J. Water SanitHyg Dev. 2(4): 10.2166/washdev. 2012.104.

Ukiwo , U. (2008). Understanding water supply reforms in Nigeria's Niger Delta: A research note. Lucy Project on Green Governance Conference, Berkeley Workshop of Environmental Politics, University of California, Berkeley.

United Nations Development Programme, UNDP. (2006). Nigeria: Niger Delta Human Development Report, Lagos.

WHO (1971). World Health Organisation International Standards for Drinking Water, 3rd ed. Geneva


Fig. 1.Neighbourhood Water Scheme

Table 1. Physical inspection of the sachet water

| Serial numbers of sachet Water | NAFDAC | | Date of Manufacture | Date of Expiry |
|---|---|---|---|---|
| | Label | Number | | |
| 1 | X | 01-3239 | Nil | Nil |
| 2 | X | A1-4834L | Nil | Nil |
| 3 | X | B1-3701L | Nil | Nil |
| 4 | X | D1-0552L | Nil | Nil |
| 5 | X | A1-6433L | Nil | Nil |
| 6 | X | C1-3087L | Nil | Nil |
| 7 | X | C1-4728L | Nil | Nil |
| 8 | X | A1-1039L | Nil | Nil |
| 9 | X | C1-6457L | Nil | Nil |
| 10 | √ | 01-40161L | Nil | 2 months after production |
| 11 | X | B1-5467L | Nil | 2 months after production |
| 12 | X | B1-0104L | Nil | Nil |
| 13 | X | 01-3060L | Nil | 2 months after production |
| 14 | √ | A1-2722L | Nil | Nil |
| 15 | X | C1-2746L | Nil | Nil |
| 16 | X | 01-4240L | Nil | 2 months after production |
| 17 | X | B1-3102L | Nil | Nil |
| 18 | X | 01-8864L | Nil | Nil |
| 19 | X | 01-2882L | Nil | Nil |
| 20 | X | *A1-2669L* | Nil | Nil |
| 21 | X | B1-2176L | Nil | 2 months after production |
| 22 | X | B1-0059L | Nil | Nil |
| 23 | X | 01-2348L | Nil | 2 months after production |
| 24 | X | 01-0160L | Nil | Nil |
| 25 | √ | A1-4854L | Nil | 2 months after production |
| 26 | X | B1-4299L | Nil | Nil |
| 27 | X | B1-2285L | Nil | Nil |
| 28 | √ | B1-8035L | Nil | 2 months after production |
| 29 | X | C1-5500L | Nil | 2 months after production |
| 30 | X | B1-1174L | Nil | Nil |

X = Without NAFDAC label

√= With NAFDAC label

**Table 2. Physico-chemical and microbiological analysis of sachet water.**

Serial numbers of sachet water

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | WHO Standard |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $P^H$ | 6.12 | 6.02 | 5.55 | 6.37 | 6.52 | 7 | 5.98 | 6.25 | 7.26 | 6.06 | 6.24 | 6.27 | 5.89 | 5.7 | 6.04 | 6.25 | 6.18 | 5.28 | 5.12 | 6.8 | 6.48 | 5.33 | 5.6 | 5.06 | 6.04 | 6.73 | 6.36 | 6.6 | 6.76 | 6.78 | 6.5-8.5 |
| Sulphate (mg/l) | <1.0 | <1.0 | 1 | <1.0 | <1.0 | <1.0 | <1.0 | 1 | 1.4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.7 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 250 |
| Nitrate (mg/l) | 0.18 | <0.05 | <0.05 | 0.17 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 0.2 | 0.17 | 0.19 | 0.19 | <0.05 | 0.18 | 0.22 | <0.05 | <0.05 | <0.05 | <0.05 | 0.25 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 50 |
| Total Dissolved Solid (mg/l) | 32 | 15.8 | 8.65 | 13.5 | 25.7 | 79.9 | 8.98 | 9.07 | 66.1 | 39.1 | 29.2 | 23.1 | 14 | 25 | 12.7 | 28.7 | 10.3 | 23.2 | 20.4 | 59.3 | 70.1 | 10.5 | 2.83 | 35.6 | 22.6 | 45.6 | 26.2 | 20.7 | 40.1 | 43.4 | 600-1000 |
| Turbidity (NTU) | 1.31 | 1.31 | 1.21 | 0.56 | 0.91 | 1.04 | 0.49 | 0.88 | 1 | 0.76 | 0.44 | 1.08 | 1.06 | 1.2 | 1.53 | 1.22 | 0.95 | 1.03 | 0.95 | 0.86 | 1.19 | 1.03 | 0.66 | 0.71 | 1.73 | 0.91 | 1.4 | 0.9 | 1.43 | 1.3 | 5 |
| E.Coliform (MPN/100 ml) | 20 | Nil | Nil | Nil | 110 | 80 | 20 | Nil | Nil | Nil | 30 | Nil | 80 | Nil | Nil | Nil | Nil | Nil | Nil | Nil | 10 | Nil | Nil | Nil | Nil | 10 | Nil | Nil | Nil | Nil | Nil |
| Total Coliform (MPN/100 ml) | 90 | 50 | Nil | Nil | 530 | 80 | 0 | Nil | Nil | Nil | 230 | Nil | 110 | Nil | Nil | Nil | 10 | Nil | Nil | 20 | 10 | Nil | Nil | Nil | Nil | 30 | Nil | Nil | Nil | Nil | 0-2 |
| THB (cufu/ml) | 14.8 | 1.7 | Nil | 0.4 | 27.2 | 8.1 | 6.3 | 0.1 | Nil | 0.1 | 23.2 | 5.9 | 3.4 | 0.9 | 0.1 | 0.2 | 2.2 | 4.9 | 3.8 | 1.1 | 4.5 | 3.3 | 0.2 | 0.1 | 5.6 | 16.4 | Nil | 2.2 | 9.1 | Nil | <100/100 |
| Electrical conductivity (µs/cm) | 49.7 | 25.1 | 14.8 | 21.6 | 40.2 | 121.1 | 14.7 | 15.1 | 100.6 | 60.1 | 5.5 | 36.4 | 22.4 | 13 | 20.6 | 44.6 | 16.7 | 36.3 | 32.2 | 90 | 107 | 17.2 | 5.59 | 55 | 35 | 69.6 | 40.7 | 32.6 | 61.6 | 67 | 1500 |

Table 3. Recorded water-borne diseases from Braithwaite Memorial Specialist Hospital (BMSH) between 2010 and 2014.

| | Diseases | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gastroentritis | | Diarrhoea | | Cholera | | Dysentry | |
| | NR | ND | NR | ND | NR | ND | NR | ND |
| Year | | | | | | | | |
| 2010 | 87 | 27 | 8 | 3 | - | - | 14 | 4 |
| 2011 | 160 | 14 | 13 | 1 | - | - | 14 | 2 |
| 2012 | 65 | 6 | 6 | 1 | - | - | 8 | 1 |
| 2013 | 105 | 4 | 66 | - | 1 | - | 24 | - |
| 2014 | 143 | 2 | 37 | 1 | - | - | 9 | 1 |
| Total | 560 | 53 | 130 | 6 | 1 | - | 69 | 8 |

NR = Number of cases reported ; ND = Number of deaths