Drinking water quality assessment: lessons learnt from Ogun State, Nigeria

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Drinking water quality assessment: lessons learnt from Ogun State, Nigeria

O. O. Oni & O. O. Yaya, Nigeria

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A drinking Water Quality Assessment survey was carried out in Ogun State Nigeria in 2009. The collected water samples were analysed in the laboratory to determine compliance with the Nigerian Standard for Drinking Water Quality (NSDWQ) and the WHO Guideline Values (WHO GLV). Results from the Study showed that high Coliform counts were recorded in many sampled sites. Only 7% compliance was recorded for the total number of samples, which needs further investigation. The pH compliance was 10%. In most areas of the State, pH range varied from 4.4 to 6.4 while Arsenic recorded 100% compliance. There was 100% compliance for Nitrate and heavy metals such as Chromium, Cadmium and Lead. Iron had 86.4% compliance ranging from 0.34mg/l -2.88mg/l. The Lessons learned were that Drinking Water Quality assessment is intensive and expensive but valuable in building the capacity of the all collaborating water organizations. It has also generated a need for revalidation study to reconfirm the level of some contaminant in some specific locations that fall short in the sanitary risk assessment scores.

Introduction

The Federal Ministry of Water Resources in Nigeria, carried out a national water supply and sanitation baseline survey in 2006/07. However, this survey only inventorised the existing infrastructure and their capacities but overlooked the quality of the waters. A number of stakeholders were of the view that the estimated percentage access and water supply coverage from the results of this survey may not be accurate as water quality considerations were omitted from the survey.

To address these gaps, the National Water Resources Institute carried out five studies in Rivers, Bayelsa, Delta,Ogun and Kaduna States as part of its research activities. Each of the studies threw up different results with sometimes unexpected results not commonly associated to previous reports from the areas. The Ogun State exercise conducted in August 2009 is the subject of this paper.

The objectives of the Ground Drinking Water Quality Assessment survey were, to reveal the actual drinking water quality of the boreholes in representative areas in every Local Government Area of the States assessed, Complement the National Water Supply and Sanitation Baseline Survey with water quality data, and determine the parameters that cause aesthetic and objectionable problems and recommend appropriate remediation/mitigation measures for the identified drinking water quality shortcomings.

Methodology

The framework and field study designs and implementation of the field activities were jointly carried out Study Teams comprising staff from NWRI and the Ogun State Rural Water Supply and Sanitation Agency.

The parameters that cause aesthetic, health and objectionable problems in drinking water of the protected sources in Ogun State were assessed. The parameters considered for the assessment were faecal coliform, pH, hardness, turbidity, chloride, total solids, nitrate, arsenic, chromium, lead, cadmium, mercury, iron, manganese, fluoride, and sanitary inspection. The study design was based on the actual number of Local

Government Areas with functional boreholes available in the report by Department of Water Supply, Quality Control and Inspectorate of the Federal Ministry of Agriculture and Water.

Project area, location and geology

The state shares an international boundary with the Republic of Benin to the West and interstate boundaries with Oyo State in the north, Lagos State in the south and Ondo State. Ogun State has two main rock types. These are the basement complex rocks of the pre- Cambrian age which are made up of the older and younger granites in the northern parts of the state, and the younger and older sedimentary rocks of both the tertiary and secondary ages in the southern parts.

Design data

In the baseline data obtained, only 428 or 57.6% of the743 boreholes were functional. Consequently, two clusters (50 samples) were allotted for Ogun State. Random table method was used to select the 50 sampling points from the diverse Local Government Areas of each State for the clusters allotted.

The field survey design was done by the National Water Resources Institute study team. In order to ensure proper survey design the team worked in partnership and collaboration with Ogun State Rural Water Supply and Sanitation Agency (RUWATSAN). The organisations were involved in drawing up the route, work plan and participated in the field exercise during the collection of water samples from selected points in all the LGAs of the States. In the case of Ogun State, a reputable laboratory, Jawura Environmental Services Limited, Lagos, was contracted to analyse the water samples because it was impracticable to collect and move the samples to Kaduna in less than twenty four hours. The members engaged for the field activities collected most of the samples as designed except where they could not find functional borehole in the sampling points, hence substitutes were made with protected hand dug wells. A 100% sample collection was achieved for the State. Alternative sites were selected where possible and codified as agreed by the teams, and the laboratory. All the samples met the 24 hours deadline for evacuation to the laboratory. The results were evaluated to determine compliance with the Nigerian Standard for Drinking Water Quality (NSDWQ) and the WHO Guideline Values (WHO GLV).

Ogun State water quality surveillance percentage compliance

The percentage summary of the results obtained from Ogun State in terms of compliance with the National Standard for Drinking Water Quality (NSDWQ) and the World Health Organisation (WHO) Guidelines value (GLV) recommended for drinking water are presented in Table 1 and 2.

Principal findings and recommendations

In the Drinking Water Quality assessment of Water in Ogun State most of the parameters had good compliance. However, cases of certain parameters recording results of public health concern were recorded with unacceptable values and the implications will be part of the discussion in this section.

High Coliform counts were recorded in many sampled sites. Only 7% compliance was recorded for the total number of samples. Purple sulphur bacteria were found in water from three sampling sites. A revalidation study is suggested to be conducted to reconfirm the result as no faecal coliform count was recorded despite the high total coliform count. There is a need for further investigation and disinfection of the Boreholes where required. Where necessary, hygiene promotion may be carried out in places that fall short in the sanitary risk assessment scores since all may not be well in such surrounding environment. This will reduce the occurrence of Water borne diseases.

A total of 14.6% of the water samples did not meet the pH compliance, their values ranged from 4.4 - 6.4 (Table 1).This may be due to natural soft water but human defective practice may be the chief cause. There is a need to discourage by sensitisation the practice of addition of Alum to water in storage tanks by the private borehole and protected well owners as a means of making the water clear without regard to dosage calculation. This is the reason why we have lot of samples with low ph in the acidic region.

There is a need to encourage a good preventive maintenance schedule to forestall breakdown of boreholes some of the sampled sites. Many of the water points were privately owned motorized dug wells. A substantial number of the Government boreholes are not functional due to bad maintenance.

It is highly recommended that a State Regulatory Agency with effective enforcement mechanism be put in place to ensure that the drinking water quality and sanity integrity of borehole water be put in place particularly when many private owners acquire one indiscriminately.

The high Coliform count observed in most of the sample was the highlight of the study and it forms an important area for further studies. It is sad that as much as 90% of sources of drinking water cannot be regarded as safe or meet the drinking water standard. An urgent intervention is required in to the causes of the high levels of Coliform counts.

Lessons learnt and recommendations

The study has generated a need for an investigation focused on specific contaminants. High Coliform counts were recorded in many sampled sites. Only 10% compliance was recorded for the total number of samples. Purple sulphur bacteria were recorded at three sampling sites. A revalidation study is recommended to be conducted to reconfirm the result as no faecal Coliform count was recorded.

The assessment is intensive and expensive but valuable in building the capacity of the Institute and the collaborating state personnel also justifies a need for a wider and integrated approach to link up the National Monitoring systems. . The Cluster Sampling Strategy through reduction of costs and time produces sampling efficiency. The use of a statistical representative snapshot is useful in a rapid exercise with a limited life span to obtain reliable baseline data of an area.

The determination of a limited range of health relevant parameters are important in the assessment study as they benefit the public common good in knowing the drinking water quality status.

Conclusion

The Study has shown the popular assumption that Groundwater is a safe and reliable source for Drinking water in most part of Nigeria can no longer be taken for granted. The Study is a starting point for setting up monitoring programmes and independent surveillance. .Overall the Drinking Water Quality (DWQ) assessment has been useful to obtain reliable data on Ogun State ground water sources. It is a wakeup call on existing problems and its present risks.

Table 1. Ogun State water quality percentage compliance

S/n	Parameters	Who glv	Who % compliance	Nsdwq	Nsdwq % compliance
1	pH	6.5 – 8.5	10	6.5 - 8.5	10
2	Turbidity	5.0	86.4	5.0	86.4
3	Total Solids	1,500	100	-	-
4	Chloride	200	100	250	100
5	T. Hardness	1000	100	150	94.2
6	Fluoride	1.5	97.8	1.5	97.8
7	Iron	0.3	86.4	0.3	86.4
8	Manganese	0.2	95.6	0.2	95.6
9	Arsenic	0.01	100	0.01	100
10	Chromium	0.05	100	0.05	100
11	Lead	0.01	100	0.01	100
12	Mercury	0.001	93.2	0.001	93.2
13	Cadmium	0.003	100	0.003	100
14	Total Coliform	10	9.5	10	9.5

Table 2. Statistical Values of Aesthetic Parameters in 30 Sampled Water Sources in Ogun State

Sampling points	Ph (field)	Ph (lab)	Turbidity ntu	Total solid mg/l	N03 mg/l	Cl- mg/l	Hardness mg/l	Fl- mg/l	Fe3+ mg/l	Mn mg/l
Maximum	7.2	6.8	17.2	615.0	4.9	99.3	100.9	2.2	0.6	0.3
Minimum	4.4	4.5	0.0	40.0	0.0	0.0	2.2	0.1	0.0	0.0
90% Percentile	6.9	6.1	2.4	267.5	0.0	37.3	78.4	0.6	0.3	0.2
Average	5.8	5.5	1.5	150.6	0.2	23.1	30.6	0.4	0.2	0.0
Standard Deviation	0.8	0.6	3.8	128.5	1.0	21.1	29.1	0.4	0.1	0.1

Keywords
Drinking, Water Quality, Assessment survey, Ogun State.

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Contact details

Name of Principal Author O. O. O. Oni
National Water Resources Institute, Kaduna.
Tel: +2348035981728
Email: adisaoni@yahoo.com

Name of Second Author O. O. Yaya.
National Water Resources Institute, Kaduna.
Tel: +2348037861677
Email:omime93@yahoo.com