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Impact of Environmental Management Practice on Ground Water Quality in Mubi Metropolis

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ABSTRACT

In this research work, the impact of environmental management practice on groundwater quality in Mubi was investigated. The investigation was carried out base on water pollution sources, which include Septic Tank, Cesspool, Deep Discharge Injection of waste, refuse disposal, Fertilizers, pit latrines Waste/dead decayed matter, Insecticides /herbicides chemicals, and groundwater infiltration and percolation. A total of eight sampling points were selected from different sources from which water was obtained by the public, and analysis was carried out using Atomic Absorption Spectrophotometer (AAS) for indicators of faecal pollution, heavy metals and other contaminants. The study revealed that the content of pH, TDS, Total hardness, Chloride, Sodium and Potassium, Sulphate, Fluoride and Coliforms, were ranged 6.87-8.50, 1210-1520mg/L,127-295mg/L, 51-81mg/L, 20-54mg/L and 12-33mg/L,36-57mg/L,0.75-1.25mg/L and 130-180cfu/100ml, respectively. It shows that there is high contents of TDS, Total Hardness and Coliforms above the recommended maximum permissible limit prescribed for drinking water quality by WHO, (2013).

KEYWORDS: Environmental management, Impact, contamination, Groundwater quality

Introduction

The evaluation of our nation ground water quality is complex. In evaluating ground water quality under Section 305(b) of the Clean Water Act, our goal is to determine if the resource meets the requirements for its many different uses. Ground water quality can be adversely affected or degraded as a result of human activities that introduce contaminants into the environment, APHA (1992). It can also be affected by natural processes that result in elevated concentrations of certain constituents in the ground water, for example, elevated metal concentrations can result when metals are leached into the ground water from minerals present in the earth. High levels of arsenic and uranium are frequently found in ground water in some western region, Clayton, (2006). Not too long ago, it was thought that soil provided a protective “filter” or “barrier” that immobilized the downward migration of contaminants released on the land surface. Soil was supposed to prevent ground water resources from being contaminated. The detection of pesticides and other contaminants in ground water demonstrated that these resources were indeed vulnerable to contamination. The potential for a contaminant to affect ground water quality is dependent upon its ability to migrate through the overlying soils to the underlying ground water resource. (Totawat, 2004). Ground water contamination can occur as relatively well-defined, localized plumes emanating from specific sources such as leaking underground storage tanks, spills, landfills, waste lagoons, and/or industrial facilities. Contamination can also occur as a general deterioration of ground water quality over a wide area due to diffuse non-point sources such as agricultural fertilizer and pesticide applications. Ground water quality degradation from diffuse non-point sources affects large areas, making it difficult to specify the exact source of the contamination. Ground water contamination is most common in highly developed areas, agricultural areas, and industrial Complexes. Frequently, ground water contamination is discovered long after it has occurred. One reason for this is the slow movement of ground water through aquifers, sometimes as little as fractions of a foot per day. This often results in a delay in the detection of ground water contamination.

In some cases, contaminants introduced into the subsurface decades ago are only now being discovered, this also means that the environmental management practices of today will have effects on Ground Water Quality in the future time, (Smith, 1994)

Material and Methods

Sources of Groundwater Contamination

Ground water quality may be adversely affected by a variety of potential contaminant sources. It can be difficult to identify which sources have the greatest impact on ground water quality because each source varies in the amount of ground water it contaminates, (Piper, 1994). In addition, each source impacts water quality differently. Therefore, this research developed a list of potential contaminant sources that threaten Mubi ground water resources. The research added sources that were necessary based on Mubi-specific concerns. When selecting sources, numerous factors were considered these, include

1. The number of each type of contaminant source in Mubi
2. The location relative to ground water sources used for drinking purposes
3. The size of the population at risk from contaminated drinking water
4. The risk posed to human health.
5. Hydro geologic sensitivity (the ease with which contaminants enter and travel through soil and reach aquifers).
6. The findings of Mubi groundwater assessments from related studies.

Sources of Ground Water Contamination in Mubi Metropolis

Septic Tank, Cesspool, Deep Discharge Injection, Fertilizer, Drinking Water Well, Waste/dead decayed matter, Insecticides/herbicides chemicals, Aquifer Confining Zone, Confining Zone Water table, ground Water Movement

Water sampling and analysis

The most important factor to take into account is that, in most communities within Mubi, the principal risk to human health derives from faecal contamination.

In some Areas there may also be hazards associated with specific chemical contaminants such as fluoride or arsenic, but the levels of these substances are unlikely to change significantly with time. Thus, if a full range of chemical analyses is undertaken on new water sources and repeated thereafter at fairly long intervals, chemical contaminants are unlikely to present an unrecognized hazard. In contrast, the potential for faecal contamination in untreated or inadequately treated community supplies is always present. The minimum level of analysis should therefore include testing for indicators of faecal pollution (thermo tolerant (faecal) Coliforms), turbidity, and chlorine residual and pH (if the water is disinfected with chlorine). usually possible to devise a rational sampling and analytical strategy. This should incorporate carefully selected critical-parameter tests in some areas

Sampling

Fourteen sampling sites were selected; Kolere, Lokuwa, W/Patuji, Sabonlayi, Yelwa, Barama,Tudun Wada, Gipalma, Madanya, Arhan Kunu, Gada, Wuro Gude, from which water was obtained by the public. For the purpose of this study, samples were collected two times in a month during July 2015 to September 2015.At this period the water level is high, therefore a total of 84 waste water samples were analysed for all parameter. These samples were taken from hand pump near waste water irrigated land. Well water and bore holes' water. The collected samples were analysed for pH, Total dissolved salt(TDS), Total hardness (TH), Alkalinity, Chloride(CL), Sodium (NA) and Potassium (K), Sulphate (SO_4) fluoride (f) and heavy metals.

Test Method Adopted

The tests used to determine the water-quality in Mubi for the purpose of this research work was microbiological quality (by the measurement of indicator bacteria) and turbidity, and for free chlorine residual and pH where chlorination is used. These tests were carried out wherever a sample is taken,
Regardless of how many other physical or chemical variables were to be measured.

Common Water Treatment Techniques and Devices:

Once contamination is detected in a drinking water supply it is important to use the proper treatment device to remove the contaminant. The following section is intended as a guide to help in the selection of a treatment device. Before buying a treatment device have the water supply tested for contamination and consult a specialist when selecting the best treatment device. If the specific contaminant is known the following methods and devices are used for treatment:
(a) Activated Alumina
(b) Activated Carbon
(c) Aeration
(d) Anion Exchange
(e) Chemical Precipitation
(f) Chlorination
(g) Distillation
(f) Ion Exhange

(g) Mechanical Filtration
(g) Neutralizing Filters
(h) Oxidizing Filters
(i) Reverse Osmosis
(j) Ultraviolet

Results and Discussion

Average level and range of various parameters were analysed in ground water samples as presented in table1 -4

Table 1: Level and range of various parameters in Kolere site

S/No	parameters	Range (mg/L)	level
1	pH	6.87- 8.5mg/L	7.64mg/l
2	Total dissolved salt (TDS)	1210-1520mg/l	1369mg/l
3	Total hardness (TH)	127-295mg/l	171mg/l
4	Coliforms	130-180cfu/100ml	155cfu/100ml
5	Chloride	51-81mg/l	61mg/l
6	Sodium & potassium	20-54,12-33mg/l	26.77mg/l
7	Sulphate so_4	36-57mg/l	40mg/l
8	Fluoride (F)	0.75-1.25mg/l	0.96mg/l

Table 2: Level and range of various parameters in Yelwa site

S/No	parameters	Range (mg/L)	level
1	pH	6.87- 8.5mg/L	7.69mg/l
2	Total dissolved salt (TDS)	1211-1525mg/l	1069mg/l
3	Total hardness (TH)	127-276mg/l	171mg/l
4	Coliforms	123-189cfu/100ml	150cfu/101ml
5	Chloride	49-8mg/l	61mg/l
6	Sodium & potassium	20-54,12-33mg/l	26.77mg/l
7	Sulphate so_4	36-57mg/l	41mg/l
8	Fluoride (F)	0.75-1.25mg/l	0.96mg/l

Table 3: Level and range of various parameters in Lokuwa site

S/No	parameters	Range (mg/L)	Average level
1	pH	6.87- 8.5mg/L	7.64mg/l
2	Total dissolved salt (TDS)	1210-1520mg/l	1369mg/l
3	Total hardness (TH)	127-295mg/l	171mg/l
4	Coliforms	130-180cfu/100ml	155cfu/100ml
5	Chloride	51-81mg/l	61mg/l
6	Sodium & potassium	20-54,12-33mg/l	26.77mg/l
7	Sulphate so_4	36-57mg/l	40mg/l
8	Fluoride (F)	0.75-1.25mg/l	0.96mg/l

Table 4: Level and range of various parameters in W/Patuji site

S/No	parameters	Range (mg/L)	Average level
1	pH	6.87- 8.5mg/L	7.64mg/l
2	Total dissolved salt (TDS)	1210-1520mg/l	1369mg/l
3	Total hardness (TH)	127-295mg/l	171mg/l
4	Coliforms	130-180cfu/100ml	155cfu/100ml
5	Chloride	51-81mg/l	61mg/l
6	Sodium & potassium	20-54,12-33mg/l	26.77mg/l
7	Sulphate so_4	36-57mg/l	40mg/l
8	Fluoride (F)	0.75-1.25mg/l	0.96mg/l

Table 5: Average level and range of various parameters in mubi as compared to prescribed limit of WHO

S/No	parameters	Range (mg/L)	Average level	prescribed limits (WHO)	Sources of parameters
1	pH	6.87- 8.5mg/L	7.64mg/l	7	Acidity of effluent
2	TDS	1210-1520mg/l	1369mg/l	50mg/l	Sewage disposal
3	TH	127-295mg/l	171mg/l	10mg/l	Sewage disposal
4	Coliforms	130-180cfu/100ml	155cfu/100ml	10cfu/100ml	Faecal, urine
5	Chloride	51-81mg/l	61mg/l	200mg/l	Organic pollution
6	Sodium & potassium	20-54,12-33mg/l	26.77mg/l	No specific value	Rock & soil
7	Sulphate so_4	36-57mg/l	40mg/l	200mg/l	Rock & soil
8	Fluoride (F)	0.75-1.25mg/l	0.96mg/l	1.5mg/l	Rock & soil

Source: Field work analysed by National metallurgical development centre Jos (NMDC) 2015

pH –Is one of the important factors of ground water. The overall range of pH within three months was 6.87-8.54mg/l with mean value of 7.64mg/l indicate that slight variation in pH
at different sites.

Total Dissolved Salts (TDS)- Is the concentration of all dissolved minerals in water. It indicates the general nature of salinity of water, this research work shows the total dissolved salt value range from 1210-1520mg/l with the average value 1369mg/l. All the samples showed higher range of TDS than the desirable limits of 50mg/l, TDS in ground water originated from natural sources, sewage, urban run-off and industrial waste (Kurian, 2001).

Total Hardness (TH) –Is considered as major character of drinking water. The total hardness in the studied area varied from127 to 295mg/l. The value of total hardness of all the samples was within the possible range of 300mg/l.

Chloride (CL)- During the period of investigation the chloride content at different sites ranged between 51 to 81mg/l, thus all the values shows that chloride content in all samples were within the permissible limit of 200mg/l. High chloride concentration indicated organic pollution (Batheja *et al.,2007)*

Conclusion

Based on findings of this research work, it was quite evident that essential qualities of drinking water found within mubi metropolis was not adequately good for consumption, compare to world health organization WHO, (2013), prescribed limits

Wherever possible the community should be involved in the sampling process. Where water is disinfected, primary health workers, schoolteachers, and sometimes community members can be trained to carry out simple chlorine residual testing. The same people could also collect samples for Physicochemical analysis and arrange for their delivery to the regional laboratory. The use of community members in this way has significant implications for training and supervision but would be one way of ensuring more complete surveillance coverage. This research therefore recommends the following act:

1. Require water quality monitoring, water treatment, and the public and the public reporting of contaminants in drinking water systems;
2. Ban the underground injection of hazardous wastes materials that can contaminate water.
3. Appropriate organs of the government at all levels should be empowered to enforce the various environmental sanitation and managements laws to ensure healthy drinking water.
4. Public awareness should be created on media and other mediums on best practices of all round environmental management in human settlements.

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