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Sanitary aspects of groundwater supplies in Ghana

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Abstract

In the past few years, government and several Non-governmental Organizations (NGOs) have carried out major borehole drilling projects in the rural areas of Ghana to increase water supply coverage which is as low as 50%, presently.

Although the quality of groundwater in the country is generally good and usable for most domestic, municipal and industrial purposes, recent evidence has, however, shown that human activities have caused contamination of aquifers in some areas. These activities include the indiscriminate disposal of refuse and human wastes around dwellings and the injudicious siting of gardens around well fields. Leachate from these diffuse sources probably, therefore, constitutes the most important source of pollution of groundwaters in the rural areas of the country.

The concern here is that groundwaters, once contaminated, are not easily restored as the source of contamination may not be easily traced because of the complexity of flow of groundwaters in the fissures of the Basement Complex Rocks. Insanitary well-head conditions resulting from poor drainage and the scouring of storage containers and drinking utensils with dirt are also some of the secondary causes of contamination of the groundwater supplies. Several measures have been evolved to eliminate the contamination problem and these are discussed in this paper.

Introduction

A readily available source of water supplies which is being increasingly exploited to increase coverage in the rural areas is groundwater. The rural water supply sector in the country involves Government, External Support Agencies, NGOs and several other actors. Generally, groundwater is of good quality throughout most of the country with low mineral content typical of the non-carbonaceous rock formations that underlie the country. But there are pockets of areas around the country where there are salinity problems and also corrosiveness due to the low carbonate buffering of the aquifers (Amuzu, 1974). In these cases, pH levels of below 6.5 are characteristic of the supplies. Much emphasis has been placed on the improvement of the quality of these supplies in the past. The monitoring of the quality of the aquifers during drilling has been used to develop the best quality aquifers. Where the supplies are corrosive, non corrosive materials have been

used for the down-the-hole parts of installations. In cases where the aquifers are ferruginous, iron removal plants have been installed to remove the excess iron from the supplies.

But it has been recognized in recent years that human activities in the vicinity of well-heads may also be causing contamination of groundwater supplies in the rural areas. The concern here is that groundwaters, once contaminated, are not easily restored as the source of contamination may not be easily traced because of the complexity of flow of groundwaters in the fissures of the Basement Complex Rocks. The concern is enhanced further by the fact that boreholes are, usually, drilled to shallow depths in these rocks and the supplies are, to a large extent, derived from unconfined aquifers which are more prone to pollution than, for example, artesian wells. Artesian wells are however not commonly found in the country.

Sources of contamination

Activities such as the indiscriminate disposal of refuse and human wastes around dwellings and the injudicious siting of farms around well fields are some of the causes of contamination of the supplies. Leachate, from these sources, which may contain bacteria, pathogens and nitrates derived from decomposing organic matter and fertilizers applied on the farms, is then transported by run-off to the wells. Very high concentrations of nitrate, up to 123.7 mg/l, have been recorded in some areas (Pelig-Ba et al 1988). Akiti (1982) reported high concentrations of nitrates in groundwater supplies in the Upper Region of Ghana and attributed the source to livestock which range freely in the area and to the use of chemical fertilizers and animal manure. Leachate from these diffuse sources probably, therefore, constitutes the most important source of pollution of groundwaters in the rural areas of the country.

Insanitary well-head conditions have, also, been known to be a major cause of contamination of groundwater supplies.

Poor drainage of spilled water, the siting of animal watering-holes and vegetable gardens too close to pump pads contribute to poor sanitation around well-heads.

A secondary contamination of these water supplies occurs at the consumer stage where the scouring of drinking utensils, such as calabashes, and water storage clay pots with dirt is commonly practised. Instances have, also, been

known where the borehole water is frequently mixed with clay to impart a much appreciated earthy taste.

Protection of supplies

Several measures have been evolved to eliminate the contamination problem. These include environmental education to improve sanitary conditions and properly selected rubbish dump sites to stop the indiscriminate disposal of rubbish around dwellings.

Emphasis is, also, laid on the location of wells and the rule of the thumb is to site wells, at least, 50 meters away from toilets, rubbish dumps and polluted pools of water. In some cases siting may compromise accessibility and favour quality for quantity. Where quantity is the over-riding concern, wells are sited near hazards with the understanding that the hazards will be removed immediately.

Site improvements at the well-head include the construction of ditch drains and the back-filling of the apron of the well with clean, coarse gravel to improve drainage. Spilled water as well as rain water is, thus, directed away from the well site to minimise the percolation of dirty water into the ground to pollute the well water.

Animal enclosures and watering holes are being re-located where they are too close to the well-head.

Bathing enclosures, with hard floors, are being constructed to direct bath water away from well heads.

Modification to well-head structures include pump venting to prevent spilled water from being sucked into the well by vacuum action created by drawdown. Well casings are also being raised above the concreted pad so that spilled water does not flow back into the well.

Where aquifers have been contaminated, de-contamination has been attempted, using strong solutions of chlorine, with mixed results. This may be related to the fact that groundwater is, usually tapped from fissures in the BCR through which the movement of water is relatively fast. Thus a source of pollution may have originated from a distance and may continuously contaminate a well until it is traced and eliminated. As groundwaters are also not subjected to some of the important purifying processes such as volatilization and photolysis that are significant in surface waters, the residence time of contaminants tend to be long and this is enhanced by the nature of occurrence of groundwaters in the BCR which minimise the filtration of contaminants.

The introduction of on-site water-quality monitoring techniques using portable analytical kits is also gaining ground. This enables rapid decisions to be taken as to whether an aquifer is suitable for further development or not depending on its quality.

Conclusion

Although groundwater quality is generally good in the country, poor sanitation around well heads may be causing secondary contamination of the sources. Indiscriminate disposal of wastes around settlements and poor drainage around well heads are some of the sources of the contamination.

Measures evolved to protect the supply sources include good management of wastes, proper siting of wells, site improvements, relocation of animal watering holes and drainage improvement around well heads.

References

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