International Journal of Engineering Research and General Science Volume 3, Issue 4, July-August, 2015
ISSN 2091-2730

Ground Water Pollution & Its Consequences

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Abstract— Groundwater is the foremost source of water for domestic, agricultural and industrial purposes in several countries. Due to industrial, municipal and agricultural waste containing pesticides, insecticides, fertilizer residues and heavy metals with water groundwater has been polluted by leaching process. The effects of groundwater pollution are wide. Human infectious disease is one of the more serious effects of water pollution, in this paper the overview of ground water pollution & its consequences over health & environment is taken. Also the possible remedies are discussed in the paper.

Keywords— GWQ, ground water, pollution, soil pollution, health effects, water pollution.

INTRODUCTION

In recent years, the increasing threat to groundwater quality due to human activities has become a matter of great concern. A vast majority of groundwater quality problems present today are caused by contamination and by overexploitation, or by combination of both **(et al. Ground Water quality Series 2006-2007)**

The crucial role groundwater plays as a decentralized source of drinking water for millions rural and urban families cannot be overstated. According to some estimates, it accounts for nearly 80 per cent of the rural domestic water needs, and 50 per cent of the urban water needs in India. **(et. al M. Dinesh Kumar)**

Groundwater is the foremost source of water for domestic, agricultural and industrial purposes in several countries. India accounts for 2.2% of the global land and 4% of the world water resources and 16% of the world population. It is estimated that one third of the world's population use groundwater for drinking. Therefore, water quality issues and its management options need to be given greater attention in the developing countries. Rigorous agricultural activities have increased the demand on groundwater resources in India. Water quality is influenced by natural and anthropogenic effects including local climate, geology and irrigation practices **(et. al. Keshav K. Deshmukh)**

the rapid growth industrialization and urbanization has created negative impact on the environment. Due to industrial, municipal and agricultural waste containing pesticides, insecticides, fertilizer residues and heavy metals with water groundwater has been polluted by leaching process. These pollutants are being added to the groundwater and soil system through various human activities and rapid growth of industrialization which affect the human health directly or indirectly. **(et. al. Keshav K. Deshmukh)**

LITERATURE REVIEW

Ground water contamination is nearly always the result of human activity. In areas where population density is high and human use of the land is intensive, ground water is especially vulnerable **(et. al. Getting Up to Speed)**
Pollutants are being added to the groundwater system through human activities and natural processes. Solid waste from industrial units is being dumped near the factories, and is subjected to reaction with percolating rainwater and reaches the groundwater level. The percolating water picks up a large amount of dissolved constituents and reaches the aquifer system and contaminates the groundwater **(et al. Ground Water quality Series 2006-2007)**
Depending on its physical, chemical, and biological properties, a contaminant that has been released into the environment may move within an aquifer in the same manner that ground water moves. (Some contaminants, because of their physical or chemical properties, do not always follow ground water flow.) **(et. al. Getting Up to Speed)**
The quality of groundwater depends on a large number of individual hydrological, physical, chemical and biological factors. Generally higher proportions of dissolved constituents are found in groundwater than in surface water because of greater interaction of ground water with various materials in geologic strata. **(et al. Ground Water quality Series 2006-2007)**

The results available for the 8 metro-cities and 22 Problem Areas indicate that groundwater problems are of diverse nature. The major problem is urban areas are related to increasing salinity, nitrate, coliform (indicators of pathogen), fluoride and in some cases micro-pollutants. **(et al. Ground Water quality Series 2006-2007)**

Human activities commonly affect the distribution, quantity, and chemical quality of water resources. The range in human activities that affect the interaction of ground water and surface water is broad.

In Chennai, India, over-extraction of groundwater has resulted in saline groundwater nearly 10 km inland of the sea and similar problems can be found in populated coastal areas around the world. (UNEP 1996)

There are no estimates of the public health consequences of groundwater pollution as it involves methodological complexities and logistical problems. Nevertheless, levels of toxicity depend on the type of pollutant. Mercury is reported to cause impairment of brain functions, neurological disorders, retardation of growth in children, abortion and disruption of the endocrine system, whereas pesticides are toxic or carcinogenic. Generally, pesticides damage the liver and nervous system. Tumour formation in liver has also been reported. **(et. al S.M.Deshapnde)**

Waste is one of the most important resources of contamination of soils. The wastes can infiltrate inside the earth and contaminate water resources as well. Almost all advanced countries call waste as "Dirty Gold" which creates value added to the waste with recycling and producing compost. Hospital waste is one of the most important and dangerous urban wastes. Some part of body tissue of a patient, needles contaminated to the dangerous diseases, surgical blades containing AIDS disease, etc. are of the wastes which are collected from hospital along with hundreds of thousand tons of ordinary waste. Disposal of hospital wastes contaminates underground waters as well. **(et. al. Nasr Khakbazl, 2012)**

EFFECTS OF GROUND WATER CONTAMINATION

The effects of groundwater pollution are wide. Human infectious disease is one of the more serious effects of water pollution especially in rural countries that are still developing and where sanitation is rarely present. This alone could cause hundreds of thousands of sicknesses in the area contaminated. An average 7 million people are sickened in the US from drinking polluted water yearly. Not only is drinking water a problem but so is swimming water. Every year beaches close all arund the US because of contaminated water that causes the side effects of vomiting, rash, hepatitus, diarrhea and much more.

Contamination of ground water can result in poor drinking water quality, loss of water supply, degraded surface water systems, high cleanup costs, and high costs for alternative water supplies, and/or potential health problems (et. al. Getting Up to Speed)

The incidence of fluoride above permissible levels of 1.5ppm occur in 14 Indian states, namely, Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal affecting a total of 69 districts, according to some estimates. Some other estimates find that 65 per cent of India's villages are exposed to fluoride risk. (et. al M. Dinesh Kumar)

Pollution of groundwater due to industrial effluents and municipal waste in water bodies is another major concern in many cities and industrial clusters in India. A 1995 survey undertaken by Central Pollution Control Board identified 22 sites in 16 states of India as critical for groundwater pollution, the primary cause being industrial effluents. A recent survey undertaken by Centre for Science and Environment from eight places in Gujarat, Andhra Pradesh and Haryana reported traces of heavy metals such as lead, cadmium, zinc and mercury. Shallow aquifer in Ludhiana city, the only source of its drinking water, is polluted by a stream which receives effluents from 1300 industries. Excessive withdrawal of groundwater from coastal aquifers has led to induced pollution in the form of seawater intrusion in Kachchh and Saurashtra in Gujarat, Chennai in Tamil Nadu and Calicut in Kerala. (et. al M. Dinesh Kumar)

POTENTIAL HEALTH PROBLEMS

A number of microorganisms and thousands of synthetic chemicals have the potential to contaminate ground water. Drinking water containing bacteria and viruses can result in illnesses such as hepatitis, cholera, or giardiasis. Methemoglobinemia or "blue baby syndrome," an illness affecting infants, can be caused by drinking water that is high in nitrates. Benzene, a component of gasoline, is a known human carcinogen. The serious health effects of lead are well known—learning disabilities in children; nerve, kidney, and liver problems; and pregnancy risks. **(et. al. Getting Up to Speed)**

Worldwide, infectious diseases such as waterborne diseases are the number one killer of children under five years old and more people die from unsafe water annually than from all forms of violence, including war. **(WHO 2002)** Unsafe or inadequate water, sanitation, and hygiene cause approximately 3.1 percent of all deaths worldwide, and 3.7 percent of DALYs (disability adjusted life years) worldwide.**(WHO2002)**

Unsafe water causes 4 billion cases of diarrhea each year, and results in 2.2 million deaths, mostly of children under five. This means that 15% of child deaths each year are attributable to diarrhea – a child dying every 15 seconds. In India alone, the single largest cause of ill health and death among children is diarrhea, which kills nearly half a million children each year. **(WHO and UNICEF 2000)**

HOW TO REDUCE:

In Indian context, it is not economically viable to clean aquifers. In the case of arsenic, methods for *in situ* treatment have already been in use in developed countries. In the United States, zerovalent, iron permeable reactive barriers (PRBs) are used *in situ* to remove chromium and several chlorinated solvents in groundwater and are tested successful for removing arsenic. India is too poor to afford some of the technologies that are successfully tried out in the West, especially United States because they are prohibitively expensive. The cost of cleaning the aquifer in the Rajasthan case was estimated to be Rs. 40 crores. **(et. al M. Dinesh Kumar)**

On-site sanitation systems can be designed in such a way that groundwater pollution from these sanitation systems is prevented from occurring.**(et. al. Wolf, L., Nick, 2015)**

Groundwater pollution is much more difficult to abate than surface pollution because groundwater can move great distances through unseen aquifers. Non-porous aquifers such as clays partially purify water of bacteria by simple filtration (adsorption and absorption), dilution, and, in some cases, chemical reactions and biological activity; however, in some cases, the pollutants merely transform to soil contaminants. Groundwater that moves through open fractures and caverns is not filtered and can be transported as easily as surface water. In fact, this can be aggravated by the human tendency to use natural sinkholes as dumps in areas of karst topography. **(Source: https://en.wikipedia.org/wiki/Groundwater_pollution # Prevention)**

Using water to remove pollutants from the soil, using chemical and aerial solvents, eliminating pollutants with incineration, helping natural organisms for breaking down atoms of pollutants, adding materials to the soil for protecting it and preventing spread of pollution to the other regions

To control soil pollution caused by the waste, the following techniques are recommended:

1. Application of effective technology for dumping waste like compressing and covering of openings and holes,
2. Dumping waste higher than the highest underground water levels,
3. Creating impenetrable layers in building of land fields
4. Creating drainage system for the collection of leachates
5. Using the gases produced in land fields.

CONCLUSION

Soil pollution is becoming a greater threat to the environment, especially as populations and industrial economies expand. Groundwater quality is being increasing threatened by agricultural, urban & industrial wastes, which leach or are injected into under lying aquifers. In many cases, the abstraction of excessive quantities of groundwater has resulted in the drying up of wells, salt-water intrusion & drying up of rivers that receives their flows in dry seasons from groundwater.

Selection of the appropriate remedial technology is based on site-specific factors and often takes into account cleanup goals based on potential risk that are protective of human health and the environment.

There are, however, challenges that water utilities would face such as building technical and managerial skills to design, install, operate and manage water treatment systems, making people pay for treated water and building knowledge and awareness among communities about groundwater quality issues and treatment measures.

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