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Underground water contamination in India: Vulnerability & overview of legal frame work

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Abstract
Ground water is a vital component and cradle of our life. The ground water resources are being used for various purposes like drinking, irrigation, industrial purpose etc. Due to geogenic and anthropogenic activities the underground water gets deteriorated in its quality. The quality of ground water is very hazardous so that they can cause diseases while consuming it. The underground water is completely exploited and they contains substances like high concentrations of fluoride, nitrate, iron, arsenic, total hardness and few toxic metal ions have been noticed in large areas in several states of India. They also contain wide varieties of dissolved inorganic chemical constituents in various concentrations as a result of chemical and biochemical interactions between water and the geological materials. This study found that the continuous disposal of effluents on land, which has limited capacity to assimilate the pollution load, has led to groundwater pollution. Since the farmers had already shifted their cropping pattern to salt-tolerant crops (like jasmine, curry leaf, tobacco, etc.) and substituted their irrigation source from shallow open wells to deep bore wells and/or river water, the impact of pollution on livelihoods was minimized it has also been noticed that in some locations industries are supplying drinking water to the affected households. This paper contains the reasons for contamination of underground water. This paper also highlights evolution and development of environmental related common laws and Functioning of various authorities and society.

Keywords: ground water, quality, exploited, environmental related common laws, functioning of authorities

Introduction
The Beginning of environmental conscience that the world people has experienced during the last thirty years, and the look of dramatic episodes of contamination around the world during the last century, have forced in many countries the need to promote laws, regulations or actions to minimize or prevent the negatives effects of human activities in all parts of the hydrological cycle. Contamination of groundwater wealth by a variety of anthropogenic pollutant from both point and non-point sources represents a key global environmental crisis. Contaminant type of concern includes solvents, fuel hydrocarbons, heavy metals, pesticides, nitrate, and radio nuclides. Groundwater contamination reflects local physical hydro geological consideration but also the inherent properties of the contaminants. An understanding of the factors controlling contaminant behavior in the subsurface is a necessary requirement to exploring possible curative solutions. These factors include the partition processes that govern the allocation of contaminant species between the aqueous phase, the solid phase (including adsorption onto soil particle surfaces), the gas phase, and, in some cases, no aqueous phase liquids. Chemical and biological change processes also impact the behavior of different types of subsurface contaminants. The designs of passive and active groundwater remediation approach often reflect consideration of one or more of these factors; however, the efficiency of most methods is often most closely dependent upon the physical uniqueness of the subsurface environment, such as the distribution of hydraulic conductive.

A critical appraisal: vulnerability and scope of remediation
Water treatment technologies
To care for polluted water major companies and research laboratories are creating many techniques by introducing new biological and viral filters for refinement. A recent technology from the National Chemical Laboratory, Pune consists of new generation filters using ultra-fine porous membranes that do not permit viral and bacterial organisms from passing through the pores and such innovations are predicted to change the scenario of water treatment in the coming years. Solutions for Fluoride and Arsenic removal also exist. But, these technologies fail because it can't able to take away harmful pollutants such as pesticides and some heavy metals. Aquifer remediation by pumping out the polluted water is still a revolutionary, expensive technology even for much developed countries.

Overcoming attitudinal problems
The feature of technology though significant, seems to be over-shadowed by other important issues. Less expensive filters for Fluoride removal such as Activated Alumina (AA) exist, but unless there is a basic consciousness and necessity, simple aspects such as periodical cleaning (regenerating crystals) of filters become an impediment towards proper functioning of these systems (Shah and Indu, 2004, IWMI-Tata, unpublished). Most communities take clean drinking water for granted and spending even a minor proportion of their income towards obtaining quality drinking water is seen as a burden. Along with these, there is also a sense of denial

on part of the government agencies in accepting the magnitude of the problem, partly due to prioritizing health problems. In North Gujarat, it was found that the government, NGOs and the doctors as well do not like to declare or diagnose 'Fluorosis' as such, rather they would like to cover 'Fluorosis' behind the mask of MSD (Muscular Skeletal Disease). It might be ignorance, indifference or apathy towards Fluorosis. A similar situation existed with respect to Arsenic in West Bengal where it is now finally accepted as a serious health risk.

Drinking water market

Preventive action is certainly the best course for both short and long term quality problems,. However, prophylactic action is seldom followed in case of water quality because of its long-term effects and endemic nature. Dissatisfaction with the quality of water provided by urban areas and due to pollution of groundwater, many urban population uses packaged drinking water for meeting their domestic needs, for example in North Gujarat (Indu, 2003). Some cities such as Chennai have as much as 20% of their water supplies being met by tanker water (Londhe et al, 2004). In Vadodara city, it is estimated that the economy of informal water markets is as large as the municipal water supply itself (TOI, 2005). Much of this water arrives from urban fringes and surrounding rural areas, therefore leading to conflicts in water rights, as observed in Tiruppur city (Janakarajan, 1999). The informal water markets are leading to conflicts between water for agriculture and that for urban areas.

Industrial pollution and prevention

The implementation of pollution control laws and treatment procedures for industrial effluents are worth more in effective way. In Ankleshwar, for example, a Centralized Secure Landfill facility has been operated by a local group of industries. It has collected and disposed off 2,00,000 MT of hazardous solid waste in its 5years of operation. Another common effluent treatment plant in the same area treats effluent from 225 member industries. This working model can be followed by other such heavily industrialized zones across the country for treatment facilities operated by groups of companies. Similar treatment plants are also coming up in other industrial towns such as Tirrupur city in Tamil Nadu.

Technologies for Arcenic underground water

The technological opportunities, to resolve water scarcity in arsenic affected areas and, to get rid of groundwater arsenic menace, can thus be thought to be as under:

- In-situ remedy of aquifers by decontaminating arsenic from infested aquifers,
- Use of groundwater after ex-situ treatment by arsenic removal devices,
- Use of surface water source as an alternate to the contaminated groundwater source,
- Exploring possibilities of tapping risk free deeper aquifers for supply of arsenic free groundwater.

The Role of Enforcement Agencies; Status and Challenges

In India, the central pollution control Board was recognized under the provision of the water (prevention and control of pollution) Act, 1972. This follows the recommendation of the special committee that was set up in 1962 to draw a draft acting out for the prevention of water pollution CPCB was a response that was sought to control the pollution of various water resources in the country that was already affecting the quality of transportable water and the overall ability of water to sustain express level of pollution by development activities.

As explained earlier, the symphony of the pollution control Boards was first defined in the Water Act of 1974. The boards are usually composed of a qualified chairman; a full time secretary; five official member; three official members each coming from the fields of Agriculture, fishing , and industry or Trade respectively; two persons representing government corporations; members of the SPCB boards; etc.

PCBs are given powers to do the following; discretion to give consent to applicants for establishing operational facilities; make, vary, or rescind orders to prevention and control of water pollution; powers of order to construction; amendment; alteration; or extension of safe disposal systems; powers to order remedial measures necessary to prevent and control pollution; planning and advisory measures; collection of information and examination laying down of standards and participation in examination and research.

Legal Challenges Facing the pollution Control Boards

Any environmental legislation is based on resources and tools for enforcement. Any pollution control authority must require instrument for such regulatory approach. These include a variety of economic incentives; fair, efficient, relevant and updated regulation with accompanying environmental standards and norms; effective guidelines for enforcement and effective public participation. For a long time since 1974, many polluters have disregarded the directions of pollution control boards and violating the conditions of consent with impurity. This is because since form the start, PCBs have not been fully empowered to exercise coercive powers of their own; and most part of this comes from the clash of jurisdiction of powers. The core of contention is the fact that PCBs face hostile legal provision for penal action against polluters.

Overdependence of the legal system is perhaps one of the major problems engulf enforcement actions by the PCBs unlike several other countries such as the US, UK, Canada and Australia where regulatory agencies have clearly defined permission to prosecute polluters without approaching the courts of law, in India, PCBs are required to approach the judiciary for this purpose. This often encourage legal squabbling by polluters.

In accordance to the EPA, the PCB must file a case before the lower court for action against a polluting unit and therefore the "onus of proof" is always vested with the PCB. The fact is lower courts are too busy to devote enough time for environment related litigations, unlike in the case of supreme court and Green Benches of Higher courts As a result, thousands of legal cases filed by PCBs against polluters are still pending for many years however, in the number of cases where decisions have been reached, polluters have been given benefit of the doubt because of failure of PCBS to satisfy the courts with the "onus of proof". Polluters also engage in extended legal squabbling even after convictions to escape deterrent penalties

Conclusion

In India, seven states namely, West-Bengal, Jharkhand, Bihar, Uttar Pradesh in the overflow plain of Ganga River; Assam and Manipur in the overflow plain of Brahmaputra and Impala rivers and Rajnandgaon village in Chhattisgarh state have so far been reported affected by arsenic contamination in groundwater above the allowable limit of 50 µg/L. People in these exaggerated states have constantly been exposed to arsenic drinking arsenic contaminated hand tube-wells water. With every new survey, more arsenic affected villages and people suffering from arsenic related diseases are being reported, and the problem resolving issues are getting difficult by a number of unknown factors. It is now generally accepted that the source is of geological origin and percolation of fertilizer residues may have played a modifying role in its further exaggeration. Discovery of parental rocks or outcrops is yet to be recognized, including their sources, routes, transport, speciation and occurrence in Holocene aquifers along fluvial tracks of the Ganga-Brahmaputra-Barrak valley. It is reported that the contaminated waters are enriched in Fe, Mn, Ca, Mg, bicarbonates, and depleted in sulphate, fluoride, chloride; pH ranged from 6.5 to 8; redox condition usually in reducing; high on organic matter content; lodged mostly in sand coatings, or sorbed on clays, HFOs, and organic matters. The usages of exterior water sources with minor treatment through prearranged piped water supply system has been proven to be a practicable solution to supply potable water in many places in West Bengal, where surface water availability is assured. Deeper aquifers underneath the contaminated shallow aquifers are found free from arsenic contamination. The deeper aquifers, which are risk free from future threat of contamination from the overlain aquifer, can provide a sustainable source of potential groundwater withdrawal. Participation of the society and making society responsible and familiar can solve many problems associated with the water insufficiency issues in the arsenic affected areas.

Suggestion

- Pollution control laws for prevention of future contamination of aquifers should be implemented.
- Sensitizing and building behavioral practice of people towards understanding that good quality water is essential for overall personal health. The expense for good quality water is a cost of prevention for their future healthcare.
- The Public system needs to supply good quality drinking water to heavily polluted areas.
- Separate mechanisms need to be developed locally because this involves a cost therefore e.g., dyeing units paying for water treatment in Tiruppur city.
- The institutions should be created so that new technologies can be adopted for water treatment and sustain their management.

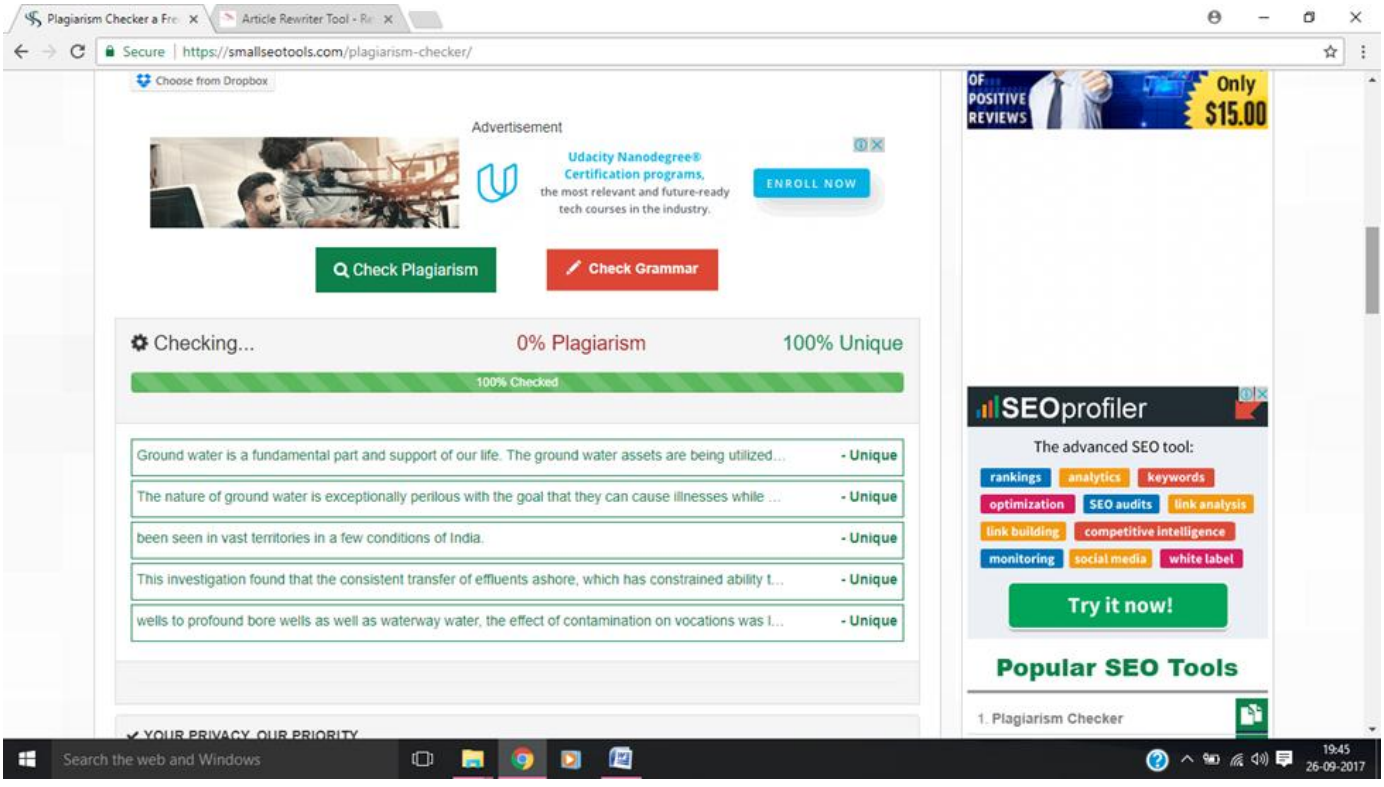

Fig 1

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